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Electrical World

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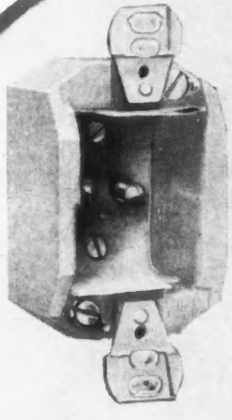

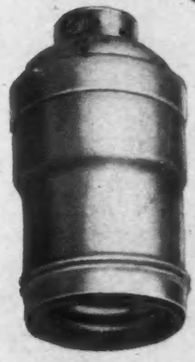

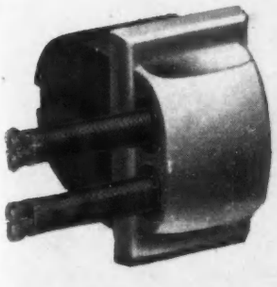

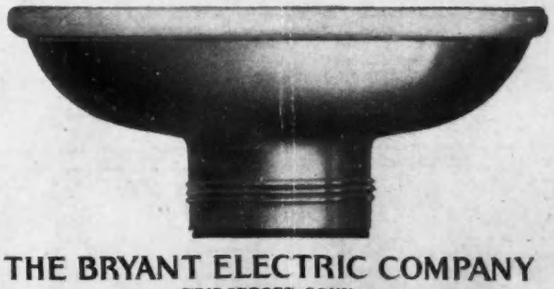

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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European Industry Needs a Helping Hand

FRANK A. VANDERLIP, a master mind in American finance, has brought to this country straight from Europe a heart-rending story of industry in an appalling state of disorganization. To all American industries the conditions bear a definite significance. Opportunities for the electrical industry are not wanting. Already there have been proposed by a prominent French concern two very definite and practical ways to assist in building up the industrial activities of France to the mutual advantage of both French and American manufacturers. One way is to establish agencies in Europe that will not only represent American mechanical and electrical manufacturers but handle the necessary credit, a problem of great importance, for credit is the greatest need of European buyers. Another way is to organize companies for renting American industrial equipment. Manufacturers of hydroelectric equipment certainly should lose no time in getting acquainted with the conditions in Italy and France. Coal is scarce in both countries, but water power is abundant in the mountain sections. By harnessing these powers we confer a lasting benefit on both countries and conserve the coal supply of the world. Power for their industries both need and must have, but it is short-sighted to ship coal, of which there is not an overabundance, when water power is available. We are just beginning to appreciate that lesson in the United States, and it has been partly learned by both France and Italy during the war. The scheme of developing the water powers of the Pyrenees and the Alps tried in the emergency of war should be carried through to fruition. American electrical engineers and manufacturers can aid in this work, and during the present crisis that aid becomes an obligation.

One reason for public displeasure over government telephone service is fundamental. You take what is given by an inexorable, impersonal system; if you do not like it, there is no real recourse. In private company operation, one can appeal over the head of the offending employee to his superior; you find a personality somewhere; but even if you fail there the all-powerful state regulating commission will function.

Hydro-Alternators Rated at 32,500 Kva. for Niagara

IT IS not so many years since the building of a 1000-kva. alternator, or one megawatt machine, was justly hailed as an epoch-making achievement. It is now announced that three alternators, each of 32,500 kva., or 32.5 megavolt-amperes, are under construction for helping to harness Niagara Falls. An interesting outline of the engineering features of one of these alternators is presented this week by W. J. Foster. Each field pole, with its winding, will weigh 3 metric tons. The cooling air is to be taken from the dynamo room, passed through the machine, and driven into a large ventilating casing, whence it can either be discharged out of doors or returned to the building. The machine is required to have the highest efficiency yet attained in hydro-alternators, yet one of the principal engineering problems of design has been to remove waste heat.

We hope that when these three machines are put into service a careful test may be made of their electrical and mechanical behavior, and that the results of the tests may be communicated to the American Institute of Electrical Engineers in such a manner as to eliminate any tendency to commercial rivalry.

The more "year-round" electrical products we can develop the better for the industry. Domestic appliances are rapidly being removed from the seasonal class by far-sighted merchandisers. While there seems little chance of establishing a horizontal or upward straight-line output in sales department work throughout the year, cultivation of the field and taking advantage of economic conditions will accomplish much.

Are They Prepared to Strike?

WE NOTE with regret that a large body of technical experts in the employ of various government bureaus have felt it necessary to unionize in order to protect their interests. It is a sorry fact that scientific men in the service of the government are ill paid. During the war they have had no relief and more hard work than ever, which has been creditably accomplished. Several instances have been cited in which investigations, for instance in the Bureau of Standards, have saved the government from being done out of very large sums by investigations which probably any well-trained engineer could have made but which would not have been committed to the proper technical care had the bureau not been at hand. We feel especially for the bureau, since it has done a large amount of admirable electrical work in spite of being continually robbed of some of its best men, hired away from it by large private institutions who are glad to pay more than the government is disposed to appropriate. Doubtless, too, the bureau will suffer more than some of the other departments from the coming of peace, inasmuch as war conditions compelled its activities to be spread over a range which will be perhaps neither feasible nor desirable at other times. Nevertheless, it is a shame that such inadequate salaries should be paid to thoroughly competent investigators. We do not feel that we are in the least exaggerating their importance in advocating

for the active heads of technical bureaus at least the salary of a humble congressman, and it assuredly is bad policy to pay assistants so inadequately that they are forced in self-defense to welcome other positions. In this country, of course, an institution like the Bureau of Standards cannot in the nature of things be accorded the wide authority that can be given for instance to the British National Physical Laboratory, for the states are jealous of their local prerogatives and most of them are equipped with state universities amply competent to deal with most of the problems which otherwise might be turned over to a national institution. Even so, it certainly is a scandal that men of the known competence of some of the heads of the national technological departments should be so poorly paid, and that many of their subordinates, charged with large responsibilities, should be struggling to get along with barely the salary of an assistant professor in some country institution. Living conditions in Washington, where these faithful men have to work, are notorious, and unless something is done to relieve the situation there will be, not a strike probably, but a gradual exodus of talent which will seriously handicap the efficiency of all the departments concerned.

It is easy to exaggerate the influence of overhead charges to a point which blocks needed development of industry. Fixed costs, so called, diminish per unit of output as production grows, and it is often within the power of efficient management to overcome the effect of a fairly high overhead by reducing unit operating expenses. Let there be no hesitation to put funds at work where economical mass production appears feasible.

Progress in Prime Movers

AS USUAL, the report of the committee on prime movers of the National Electric Light Association, which was abstracted in last week's issue, contains much valuable material. To a certain extent the war has checked the normal course of developments in some lines and actually hastened it in others. That part of the report which deals with the prime movers themselves refers particularly to size of units, a subject which has frequently been discussed heretofore. That the rating of the big generating sets in large stations has steadily increased is a matter of common knowledge. The main question is, what is the maximum size of unit that can be employed to advantage? This, of course, depends on the whole capacity of the station concerned. We recently described a 70,000-kw. composite unit, the largest yet recorded, but a single-shaft set of 45,000 kw. rating is already in service, and the end perhaps is not yet. For very large ratings the composite unit, coupled together electrically only, is very likely the coming form, combining as it does large output at very high efficiency with a considerable amount of intrinsic reserve in case of accident. The tables prepared by the committee show that in many cases a single generating set may comprise 25 per cent or more of the total generating capacity, and the question of reliability therefore looms large. It is the judgment of the committee that the records of the big machines already in service indicate that the policy of intrusting at least a quarter of the load to one unit is not an unwise one. The difficulties in these large sizes appear from the records to be almost entirely mechanical. While there have been a number of accidents, the outlook seems to be for a decided reduction of difficulties as experience is gained with the larger sizes accompanied by a degree of security equal to that found with machines of lesser output.

The great opportunity for improvement in the operation of turbo-generator plants seems at present to lie back of the turbine itself, which is progressing faster than its supply equipment. There is a strong tendency toward higher boiler ratings in recent plants, and with this comes the necessity to which we have often referred of getting back to improvements in furnace and stoker design as the last resort in economy. Essentially the steam plant up to the turbine is the place where the maximum improvement from the dollars-and-cents standpoint can be made. The turbine itself is a wonderfully efficient machine within the temperature limits for which it is designed. Between it and the coal pile there are ample opportunities for gain. Very great boiler ratings can be obtained by low ratios of heating surface to grate surface, and beyond this there must be facilities for efficiently burning, through a suitable adjustment of furnace capacity, grate capacity and draft, the requisite amount of fuel to maintain a high average efficiency over a rather wide range of steam demand. The quality of the fuel is another vital factor, and a suitable water supply is equally necessary to the best performance of the boilers. Generally, therefore, the best boiler ratings and performance are obtained by plants equipped with surface condensers where the minimum trouble with bad water is found.

Aside from the furnaces and boilers as such, the greatest gain in economy comes in increasing the temperature range in the prime mover proper and hence raising its thermodynamic efficiency. Herein are concerned the two allied questions of boiler pressure and superheating. The superheater design has not been considered as fully in this country as it should have been, practice having been confined in the past to degrees of superheating so modest as not to be of profound significance in economy. The final phase of the matter is the resulting steam temperature at the turbine. The proper relation of boiler pressure to superheat, the two factors determining the final quantity, does not seem to have been very thoroughly studied, and more information on it is highly desirable. Practice is certainly heading upward, and we believe the time is coming when the average boiler pressures in use to-day will be looked back upon much as we now turn the historical eye on the square-stayed boilers and atmospheric pressures of two generations ago.

The committee reports that, in spite of minor difficulties, each of these installations is regarded as operating satisfactorily. No troubles have developed in the boilers or turbines, although a few have appeared in flange joints, valves and similar places. The present limit on ultimate temperature seems to be set by the physical properties of commercial steels when pushed to and maintained at high temperatures. On the other hand, the fact that the troubles just referred to have not been with the boilers but with the accessories, in which other matters than tensile strength controlled the situation, would indicate that final temperatures around 700 deg. Fahr. are entirely manageable without going to extraordinary boiler design. In what proportions this temperature should be associated with the boiler and with the superheater remains still to be practically determined as a matter of economics. The future of the

efficient production of electrical energy from steam units lies in the increase of thermodynamic utilization due to wide temperature range and in the improvement of furnace design and practice so as to utilize effectively fuel of minimum cost. We have published of late not a few items regarding the successful employment of low-grade fuels, and this, although necessarily confused with problems of transportation, still remains the most promising channel for economic gains. The ultimate desideratum in a steam plant is the lowest feasible cost of fuel and upkeep per pound of steam at the highest practicable temperature.

Thoroughness in cost accounting runs into money fast where reliable data are sought for comparative purposes. Superficial records of construction and operating expense, however, are of little value, and it is better to "go the limit" on a few jobs at stated intervals than to rely upon fragmentary information on all jobs handled as the base of advancing practice. Accuracy has always "come high," but it is worth paying for in dealing with engineering units.

Standardizing Industrial Equipment

THOSE of our readers who have an interest in the intricacies of electrically equipped industrial plants will appreciate the article in this issue by E. E. George dealing with the gains which are to be made, and which in his own special experience have been made, by properly standardizing electrical methods and the supplies required for their application. The plant under consideration is a large producer of machine tools, and the first step taken was completely to rehabilitate the electrical layout. To this end the old generating plant was laid aside and power in the form of 4400-volt, three-phase energy was purchased. The necessities of the case require both three-phase and direct-current motors, and so, while the larger motors were operated upon the power directly received, a 300-kw. synchronous motor directly coupled to a 115-volt direct-current generator found active employment. This particular voltage was chosen on account of its ready applicability to modern lamps and to the charging of batteries for trucks and tractors. Moreover, in connection with the generator a storage battery was floated on the lines, operating a wide variety of accessory apparatus, including emergency lights for the factory.

A great deal of pains was taken toward the thorough standardization of wiring, switchboards and motor equipment, so as to reduce to a minimum the varieties of material to be purchased and kept in stock. One of the great savings in this particular was in reducing to comparative uniformity the sizes and type of wires and conduit to be used. In the original plant seventeen sizes of conductor were included, some of them in several varieties. When the work of rehabilitation was done only ten sizes were utilized, each of these in but a single standard type, which greatly decreased the stock of wire necessary to be carried. Conduit sizes and wiring material were also standardized, to the great simplification of the entire work. In a similar fashion all the switches were brought down to the minimum number of types really necessary, and the wiring layout throughout was reduced as nearly to uniformity as careful selection made practicable. Throughout the requirements of safety were borne in mind, so that the final installation more than complies with the latest code requirements.

Overhead Lines and Inductive Interference

AT THE convention of the National Electric Light Association in Atlantic City an important report was read from the committee on overhead lines and inductive interference. This subject is of great technical and industrial significance. It relates to the relative rights, privileges and spheres of influence of the electric lighting and power companies on the one hand and of the telephone companies on the other.

Both the power companies and the telephone companies are naturally and rightfully extending their conducting networks over the country. They tend, therefore, to interfere more and more each succeeding year. Because the interference is distinctly one-sided, public sympathy is most likely to be found on the side of the telephone as against the turbo-alternator. It must be remembered, however, that both the power house and the telephone exchange are public service institutions and, as such, both have a right to fair consideration. The interference between them is largely a matter of public inconvenience. If the public demand for electric light and power distribution were so great as to overshadow every other consideration, then interference with telephonic traffic might be regarded as an unfortunate incident. On the other hand, if the public demand for telephonic communication transcended that upon every other electrical utility, then any interference with the telephonic service might be regarded as a serious offense against the rights of the community. As a matter of fact, it may be accepted that the public desires to retain both the electric lighting and the telephonic utilities without giving great preponderance to either. Consequently it becomes necessary to take such steps as may be economically possible to reduce interference to a minimum.

To the committee's report is appended a more technical article, by John B. Taylor, on the questions involved in interference. This article shows how important it is that there shall be active coöperation between the power and telephone companies, and particularly between their engineers, to work together in the public interest, and for their joint benefit, so as to avoid interference. Such friendly coöperation is far more likely to be advantageous to both parties than a spirit of hostility and litigation.

One plan which is likely to commend itself to both parties is to require from their own engineers some knowledge of the other side's technique. It will probably pay the power companies to engage electrical engineers who know something about telephone engineering, and it will likewise be advantageous for the telephone companies to employ electrical engineers who have some acquaintance with power transmission. This interchange of technical understanding is particularly desirable in the line construction and maintenance departments. By cultivating such mutual understanding throughout the interference difficulty can be minimized without great expense, whereas if both sides go to law the ultimate results may be both expensive and unsatisfactory.

Advocates of mass production should support research and development work with enthusiasm. This is no paradox, for progress stimulates demand, lowers unit costs or substitutes service of greater worth, and in the long run yields higher profits than can result from excessive duplication. It takes sound judgment to determine when to change gears, as it were.

Cost Comparison of Transformer Types

Rational Method of Proportioning Dimensions of Single-Phase Transformers to Obtain Minimum Cost for Material—Comparison Between Five Types of Single-Phase Transformer Designed from Same Specifications

BY B. C. DENNISON
Department Electrical Engineering, Carnegie Institute of Technology

A RATIONAL method of transformer design applied to single-phase shell-type transformers was presented in an article by the author published in the ELECTRICAL WORLD, Nov. 3, 1917. In the present article the same method of design is developed for core-type and multiple-magnetic-circuit transformers. A comparison is then made between preliminary designs of five types of transformers of the same rating, all designed to the same specifications and for essentially the same flux and current densities.

SYMBOLS EMPLOYED

The following symbols are employed:

A_i = gross area of iron core.
A_o = gross area of coils in opening.
c = height of opening (see Fig. 1).
a = width of opening.
h = gross depth of core section.
b = width of single core.
k_i = space (stacking) factor of iron.
k_c = space factor of copper.
V_i = net volume of iron.
V_c = net volume of copper.
w_i = loss per cubic inch of iron core.
w_c = loss per cubic inch of copper.
C_i = cost per cubic inch of core, including labor.
C_c = cost per cubic inch of copper, including insulation and labor.
$P = A_i \times A_o$.
E = high-tension kilovolts.
T = high-tension turns in series.
B = flux density in core (kilo-lines per square inch.).
ϕ = total flux in core, in megalines.
s = current density in copper (kilo-amperes per square inch).
I = high-tension current at rated kva.

Design Precedure Outlined.—

1. In the previous article it was shown that the preliminary design of a transformer may be made with ease and rapidity. Starting with the fundamental design equation

$$P = A_o A_i = \frac{KVA \times 10^5}{2.22 f s B K_c K_i}$$

and employing the ratio factors

x = height of opening divided by width of opening.
y = depth of core divided by width of core.
z = gross area of core divided by gross area of opening.

2. The ratio factors may be chosen to give the minimum cost for materials, x and y being simple functions of z and $k_c C_c / k_i C_i$, while z is given by the equally simple expression $z = (\alpha + \beta q)$; $k_c C_c / k_i C_i$, α and β being constants.

3. Having chosen the dimensions for minimum cost, the proper proportion between the iron and copper losses may be realized by adjusting the values of flux and current density, keeping the product $B \times s = P'$, unchanged. Thus,

$$B = \sqrt{F} \times \sqrt[4]{\frac{npV_c}{mV_i}}$$

as developed in previous article.

Calculations for the shell-type transformer with rectangular core, uniform flux density and shell types with non-uniform flux density were set forth in the previous article. Other types are now taken up.

Core-Type Transformers with Rectangular Cores and Uniform Flux Density.—An expression for the volume of iron and copper is first derived and then the proportions to give minimum cost of material are determined.

By reference to Fig. 1 it may be seen that the iron volume

$$V_i = 2bhk_i(a + 2b + c)$$

or, allowing for the corners,

$$V_i = 2bhk_i(a + 1.66b + c) = 2k_iA_i(a + 1.66b + c) \quad (1)$$

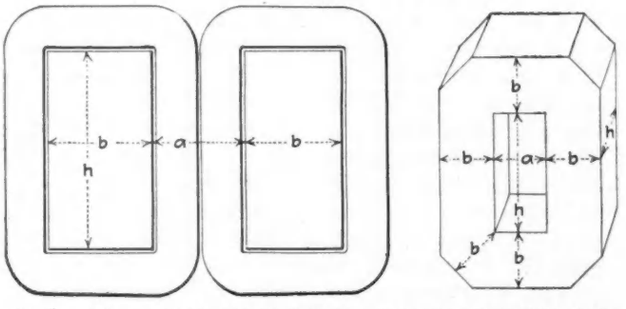


FIG. 1—CORE-TYPE TRANSFORMER WITH EQUAL CORE AND YOKE AREAS

Volume of Copper.—

$$V_c = 2A_o k_c (h + b + \frac{\pi}{4} a) \quad (2)$$

Since $A_i A_o = P$, $A_i/A_o = z$, $ac = A_o$, and $c/a = x$, $hb = A_i$, and $h/b = y$,

Then $a = (P/zx^2)^{\frac{1}{4}}$, $c = (Px^2/z)^{\frac{1}{4}}$, $h = (Pzy^2)^{\frac{1}{4}}$, and $b = (Pz/y^2)^{\frac{1}{4}}$ (3)

From equation (1) and equations (3),

$$V_i = 2k_i \sqrt{Pz} \left[\sqrt[4]{\frac{P}{zx^2}} + 1.66 \sqrt[4]{\frac{Pz}{y^2}} + \sqrt[4]{\frac{Px^2}{z}} \right] \quad (4)$$

Likewise from equation (2) and equations (3),

$$V_c = 2k_c \sqrt{\frac{P}{z}} \left[\sqrt{Pzy^2} + \sqrt[4]{\frac{Pz}{y^2}} + \frac{\pi}{4} \sqrt[4]{\frac{P}{zx^2}} \right] \quad (5)$$

Substituting from equation (4) and equation (5) in the expression for total cost of material, namely, in

$V_i C_i + V_c C_c$ = cost (to be a minimum),

and taking partial derivatives with respect to each of the ratio variables, equating each time to zero, the following expressions are obtained:

$$x = 1 + \pi R/4z \quad (6)$$

$$y = 1 + 1.66z/R \quad (7)$$

and

$$\frac{1+x}{\sqrt{x}}+5\sqrt{\frac{z}{y}}-R\left(\frac{1+y}{\sqrt{yz}}+\frac{3\pi}{4\sqrt{xz}}\right)=0 \qquad (8)$$

Where $R=\dfrac{k_c\,C_c}{k_i\,C_i}$.

Solution for values of z satisfying equation (8) was made as for shell-type transformers in the previous article, and the results, when plotted against R (see Fig. 2), show that

$$z=0.2+0.54R \qquad (9)$$

Examples of Core-Type Transformer Design.—Given: 15-kva., 60-cycle, 2200-volt transformer. Assume $B=65$, $s=0.8$, $C_c=\$0.115$, $C_i=\$0.0286$.

Various examples were worked out, starting with the theoretical ratios as obtained above, then changing these ratios to determine whether minimum cost actually corresponded with the theoretical values and to what extent the cost increased with departure from these values. The results obtained are tabulated below, and costs are plotted in Fig. 3.

Losses and Efficiency.—So far as the determination of the dimensions is concerned, it may be considered that only the product, Bs, has been fixed in the transformers designed. Their proper values, in order that iron loss shall bear a desired relation to copper loss, are determined as follows:

Let the desired ratio of losses, $\dfrac{W_i}{W_c}$, be $p=0.6$. Then for the transformer employing the ideal relations x, y, and z, *i.e.*, for the first design,

$Bs=P'=65\times0.8=52$, $V_i=800$, $V_c=248$

From equation $B=\sqrt{P}\sqrt[4]{npV_c/mV_i}$ (10)*

$$B'=\sqrt{52}\sqrt[4]{\frac{0.82\times0.6\times248\times10^4}{0.58\times800}}=51.2$$

Then $s'=52/51.2=1.015$.

These values of B and s are permissible.

Iron Loss.—The loss per pound at 51 kl. per sq. in. = 0.54 watt. Then iron loss = $800\times0.54\times0.28=121$ watts.

Copper Loss.—The copper loss = $0.82\times(1.015)^2\times248=208$ watts. Per cent loss at full non-inductive load:

Per cent loss = $(208+121)10^2/(15000+329)=2.14$

Efficiency = $100-2.14=97.86$ per cent.

Core-Type Transformers with Rectangular Cores of Unequal Areas (Non-uniform Density).—Following the method employed for the uniform-density core type the design for minimum cost of non-uniform density transformers is carried out.

Volume of Iron.—In the core shown in Fig. 4, in which the yoke areas are 1.3 times the core areas, allowing for the corners,

$$V_i=2A_ik_i(1.3a+1.82b+c) \qquad (11)$$

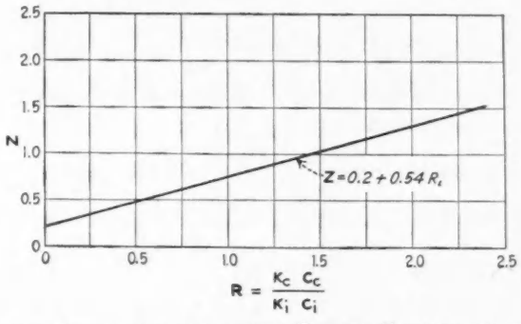
Volume of Copper.—

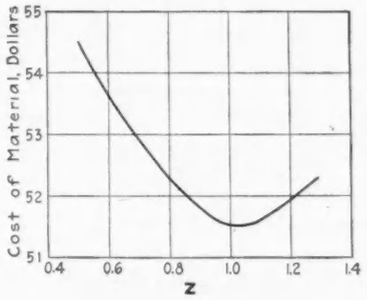
$$V_c=2A_ok_c\,(h+b+\pi a/4) \qquad (12)$$

Cost of material, expressed in x, y, z and P, becomes

$$D=2k_iC_i\sqrt{Pz}[1.3\sqrt[4]{P/zx^2}+1.8\sqrt[4]{Pz/y^2}+\sqrt[4]{Px^2/z}]$$
$$+2k_cC_c\sqrt{P/z}(\sqrt[4]{Pzy^2}+\sqrt[4]{Pz/y^2}+\pi/4\sqrt[4]{P/zx^2}) \qquad (13)$$

This is to be a minimum.





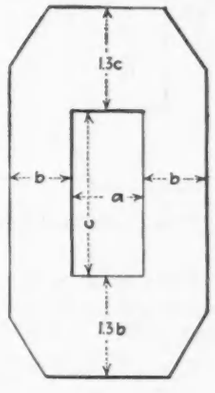


FIG. 2—VARIATION OF RATIO Z WITH R CORE-TYPE TRANSFORMER WITH UNIFORM FLUX; FIG. 3—DEPENDENCE OF COST OF IRON AND COPPER ON Z; FIG. 4—PROPORTIONS IN CORE-TYPE TRANSFORMER WITH NON-UNIFORM FLUX

Equating the partial derivatives to zero and simplifying, the following expressions result:

$$x=1.3+\pi R/4z \qquad (14)$$

$$y=1+1.82z/R \qquad (15)$$

and

$$f'(x,y,z)=\frac{(1.3+x)}{\sqrt{x}}+5.46\sqrt{z/y}-$$
$$R\left(\frac{1+y}{\sqrt{yz}}+\frac{3\pi}{4\sqrt{xz}}\right)=0 \qquad (16)$$

Equation (16) was solved in the same manner as were similar expressions in the earlier examples, and the value of z, when plotted as a function of R, gave the expression

$$z=0.57R \qquad (17)$$

In a redesign of the core-type transformer but for unequal core of sections a reduction in cost of material of 6 per cent is obtained over the core-type with uniform density, without sacrifice in efficiency.

TABLE I—EFFECT OF CHANGING Z, TOTAL COST

In these examples the greatest increase over the minimum cost is 5½ per cent

Design No.	x	y	z	A_o	A_i	a	b	c	h	V_i	V_c	Costs of Coils	Costs of Iron	Costs of Total
1	2.25	2.0	1.0	26.2	26.2	3.4	3.6	7.7	7.2	800	248	$23	$28.5	$51.5
2	2.25	2.0	0.5	37.2	18.6	4.1	3.0	9.2	6.1	612	320	36.8	17.5	54.3
3	2.25	2.0	0.75	30.3	22.8	3.7	3.4	8.3	6.7	740	276	31.7	21.2	52.9
4	2.25	2.0	1.25	23.5	29.4	3.2	3.8	7.3	7.7	893	231	26.6	25.5	52.1

*For derivation of this equation see previous article by author. m = core loss constant and n = specific resistance of copper.

In this design the following values were obtained:

$x = 2.7$, $y = 2$, $z = 0.9$

$V_i = 775$ cu.in.

$V_c = 227$ cu.in.

Cost of iron = \$22.10

Cost of coils = \$26.10

Total cost = \$48.20

Copper loss = 119 watts

Iron loss = 189 watts

This iron loss is too high, while the copper loss is correspondingly low.

To obtain the densities which will give a proper relation between the losses it is convenient to speak of the equivalent flux density—*i.e.*, that which would give the same iron loss as now exists provided it obtained throughout the entire core. In the example being considered, in 347 cu.in. of the core the flux density = B,

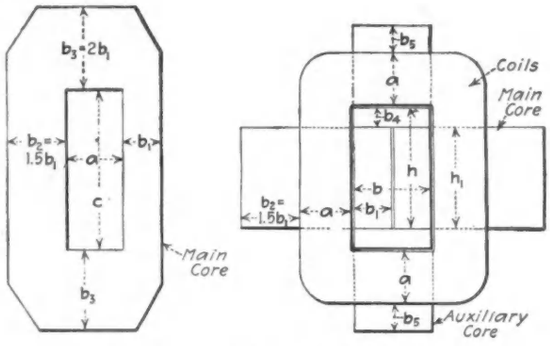


FIG. 5—MULTIPLE-MAGNETIC-CORE TRANSFORMER

while for 428 cu.in. the density = $B/1.3$. This equivalent density may be solved for as follows:

$$347 \times B^2 + 428 \times (B/1.3)^2 = 775 \times B^2_{eq},$$

$$\text{Or } B_{eq} = 0.88B$$

$$\text{Thus } B_{eq} = 0.88 \times 75 = 66 \text{ kl.}$$

From equation (28) of the first article for the correct relation, p, of iron loss to copper loss $P' = B_{eq}s = 66 \times 0.8 = 52.7$. If $p = 0.6$,

Then

$$B'_{eq} = \sqrt{52.7}\sqrt[4]{\frac{0.82 \times 0.6 \times 227 \times 10^4}{0.58 \times 775}} = 51.2\,kl.$$

The new current density should be

$$s = P'/B'_{eq} = 1.03 \text{ kiloamp. per sq.in.}$$

New iron loss = $775 \times 0.28 \times 0.55 = 119$ watts.

New copper loss = $0.82 \times (1.03)^2 \times 227 = 198$ watts.

$$\text{Per cent loss} = \frac{(119 + 198)10^2}{15{,}000 + 119 + 198} = 2.06.$$

Efficiency = 97.94 per cent.

Multiple-Magnetic-Core Transformers.—Fig. 5 illustrates the multiple-magnetic-core transformers now used so extensively for distributing service. With the relative core widths shown in the sketch the volume of iron (ignoring corners) is expressed as follows:

(a) Main core:

$$V'_i = 2k_ih_1[(b_1 + b_2)(c + 2b_2) + 2b_2a]$$

But $b_1 = b/2$, $b_2 = 1.5b_1 = 0.75b$, $b_3 = 2b_1 = b$, $h_1 = (h - b/2)$

Therefore

$$V'_i = 2k_i\,(1.25bch + 2.5b^2h + 2abh - 0.625b^2c - 1.25b^3 - ab^2) \quad (18)$$

(b) Auxiliary core:

$$V''_i = 2k_ih_2[(b_4 + b_5)(c + 2b_6) + 2b_6a]$$

But

$b_4 = 0.5b_1 = 0.25b$, $b_5 = 0.75b_1 = 0.375b$, $b_6 = b_1 = 0.5b$, $h_2 = 2b_1 = b$.

Therefore

$$V''_i = 2k_i(0.625b^2c + 0.625b^3 + ab^2) \quad (19)$$

Total volume, from equations (18) and (19):

$$V_i = 2k_ibh(1.25c + 2.5b + 2a - 0.625b^2/h) = 2k_iA_i(2a + 2.5b + 1.25c - 0.625b^2/h) \quad (20)$$

Or, allowing for corners removed,

$$V_i = 2k_iA_i(2a + 2.4b + 1.25c - 0.67b^2/h) \quad (21)$$

When written in terms of the unknown relations x, y and z, and of the product P, (21) becomes,

$$V_i = 2k_i\sqrt{Pz}[(1.25(Px^2/z)^{\frac{1}{4}} + 2.4\sqrt[4]{Pz/y^2} + 2\sqrt[4]{P/zx^2} - 0.67/y \times \sqrt[4]{Pz/y^2})] \quad (22)$$

Volume of Copper.—(See Fig. 5).

$$V_c = 2A_ok_c(h + b + \pi a/2),$$

total cost, or $D = V_iC_i + V_cC_c$, is to be a minimum.

Writing total cost of materials in terms of x, y, z and P, and simplifying by dividing by $P(P)$

$$\text{Cost} = 2k_iC_i\sqrt{z}\,[1.25\sqrt[4]{\frac{x^2}{z}} + 2.4\sqrt[4]{\frac{z}{y^2}} + 2\sqrt[4]{\frac{1}{zx^2}} - \frac{0.67}{y}\sqrt[4]{\frac{z}{y^2}} + 2k_cC_c\sqrt{\frac{1}{z}}\left[\sqrt[4]{zy^2} + \sqrt[4]{\frac{z}{y^2}} + \frac{\pi}{2}\sqrt[4]{\frac{1}{zx^2}}\right] \quad (23)$$

Taking partial derivatives, equating to zero and simplifying, it is found that

$$x = 1.6\left(1 + \frac{\pi k_cC_c}{4k_iC_i} \times \frac{1}{z}\right) = 1.6\left(1 + \frac{\pi R}{4Z}\right) \quad (24)$$

$$y = (0.5 + 1.2z/R) + \sqrt{(0.5 + 1.2z/R)^2 - 2 \times z/R} \quad (25)$$

$$f'(x, y, z) = z\left(\frac{7.2y - 2.0}{y^{\frac{1}{2}}}\right) + \sqrt{z}\left(\frac{1.25x + 2}{\sqrt{x}}\right) - R\left(\frac{1 + y}{\sqrt{y}} + \frac{3\pi 1}{2\sqrt{x \,.\, z}}\right) = 0 \quad (26)$$

The solution of equation (26) is somewhat more involved than that of the similar equations in former examples, but the solution yields a very simple expression for the unknown z, namely

$$z = 0.1 + 0.49R \quad (27)$$

Examples of Design.—The method just derived will be applied to the design of a 100-kva., 60-cycle, 2200/220-volt multiple-magnetic-circuit distributing transformer.

Assumptions:

$B = 90$ kl. per sq.in., $s = 1.3$, $C_c = \$0.175$, $C_i = \$0.035$, $k_i = 0.85$, $k_c = 0.35$.

Then $R = (0.175 \times 0.35)/(0.035 \times 0.85) = 2.05$.

From equations (27), (24) and (25)

$z = 1 + 0.49 \times 2.05 = 1.1$,

$x = 1.6(1 + 0.785 \times 2.05/1.1) = 3.94$, say, 4.0,

$y = (0.5 + 1.2 \times 1.1/2.05) + \sqrt{(0.5 + 1.2 \times 1.1/2.05)^2 - 2 \times 1.1/2.05} = 1.67$.

From the specifications and values assumed,

$$P = A_iA_o = \frac{100 \times 10^5}{2.22 \times 60 \times 1.3 \times 90 \times 0.35 \times 0.85} = 2175$$

Then

$A_o = \sqrt{2175/1.1} = 44.3$ sq.in., $A_i = 2175/44.3 = 49$ sq.in.

$a = \sqrt{44.3/4} = 3.32$ in., $c = 44.3/3.32 = 13$ in.

$b = \sqrt{49/1.67} = 5.44$ in., $h = 51.2/5.44 = 9.1$ in.

From equation (21)

$V_i = 2 \times 0.85 \times 49\,[1.25 \times 13 + 2.4 \times 5.44 + 2 \times 3.3 - 0.67(5.44/9.1)^2] = 2840$ cu.in.

Iron Loss.—It may be shown that in the core of the proportions chosen (see Fig. 5), having densities of B, $\frac{3}{4}B$ and $\frac{1}{2}B$, the iron loss equals that resulting if an equivalent density of the value $\frac{3}{4}B$ were common to all parts of the core; *i.e.*, for $B_{max} = 90$, $B_{eq} = 60$ kl. per sq.in. Therefore, looking up the iron loss at 60 kl., or 0.74 watts per lb., the iron loss becomes,

$$W_i = 0.74 \times 2840 \times 0.28 = 590 \text{ watts.}$$

Volume of Copper.—

$V_c = 2 \times 0.35 \times 44.3(9.1 + 5.44 + 1.57 \times 33) =$ 610 cu.in.

Cost of cores $D_i = 2840 \times 0.035 =$ \$99.5.

Cost of coils, $D_c = 610 \times$ \$0.175 = \$106.5.

Copper loss, $W_c = 610 \times 0.82 \times (1.3)^2 = 845$ watts.

Total cost = \$206; total loss = 1435 watts.

TABLE II—COMPARATIVE DESIGNS OF SEVERAL TYPES OF TRANSFORMERS

Specifications: 75-kva., 60-cycle, 2200/220-volt, single-phase, distributing

	Shell, Uniform Flux	Shell, Non-Uniform Flux	Core, Uniform Flux	Core, Non-Uniform Flux	Multiple-Magnetic-Circuit
B_{max}	60	90	60	70	90
s	1.3	1.3	1.3	1.3	1.3
k_c	0.35	0.35	0.32	0.32	0.35
k_i	0.85	0.85	0.85	0.85	0.85
R	1.65	1.65	1.5	1.5	1.65
P	2425	1620	2650	2260	1620
z	2.7	1.2	1.0	0.85	0.9
x	2.0	3.3	2.2	2.7	4.0
y	2.4	2.8	2.0	2.0	1.7
A_o	30	36.9	51.5	51.5	42.4
A_i	81	44.0	51.5	44	38.2
a	3.87	3.32	4.84	4.35	3.3
c	7.75	11.1	10.6	11.75	12.8
b	2.87	2.0	5.1	4.68	4.75
h	14	11.1	10.1	9.2	8.05
V_i	2250	2130	2085	1940	2085
W_i (watts)	470	440	433	408	432
D_i (dollars)	78.8	74.5	73.2	67.8	72.9
V_c	595	588	625	570	534
W_c (watts)	815	810	865	788	740
D_c (dollars)	83.3	82.2	87.5	80	74.8
Total loss	1285	1250	1300	1196	1172
Total cost	162.1	156.7	160.7	148	147.5
Efficiency	98.31	98.37	98.30	98.45	98.47

Per cent loss = $1435 \times 10^2/101{,}400 = 1.4$ per cent.

Efficiency = 98.6 per cent.

Example 2.—A certain transformer of the multiple-magnetic-core type which was examined was found to have the following proportions:

$$x = 2.44, \quad y = 1.37, \quad z = 0.66.$$

Designing the transformer of the above specifications to these proportions gives the following:

$A_o = \sqrt{2175/0.66} = 57.3$ sq.in., $A_i = 2175/57.3 =$ 38 sq. in.

$a = \sqrt{57.3/2.44} = 4.85$ in., $c = 57.3/4.85 = 11.85$ in.

$b = \sqrt{38/1.37} = 5.25$ in., $h = 38/5.25 = 7.25$ in.

$$V_i = 1.7 \times 38(1.25 \times 11.85 + 2.4 \times 5.25 + 2 \times 4.85 - 0.67\left[\frac{(5.25)^2}{7.25}\right] = 2140 \text{ cu.in.}$$

Cost of cores, $D_i = 2140 \times$ \$0.035 = \$75.

Iron loss, $W_i = 2140 \times 0.74 \times 0.28 = 443$ watts.

$V_c = 0.7 \times 57.3(7.25 + 5.25 + 1.57 \times 4.85) = 805$ cu.in.

Copper loss, $W_c = 0.82 \times (1.3)^2 \times 805 = 1115$ watts.

Cost of coils = $805 \times$ \$0.175 = \$141.

Total cost = \$216. (This exceeds that of the theoretical design by some 5 per cent.)

Total loss, $W_i + W_c = 1558$ watts.

Per cent loss = $1558 \times 100/101{,}560 = 1.53$ per cent.

Efficiency = 98.47 per cent.

It would be easy to adjust B and s so that the proper relations existed between iron and copper losses.

Comparison of Types of Transformers.—It may be of interest to compare the five types for which the method of minimum cost has been derived, by designing to the same specifications a transformer of each type. In Table II the corresponding figures are brought together and a comparison made.

All five transformers are designed for the same effective flux density—*i.e.*, for 60 kilo-lines per sq.in.—and for a current density of 1300 amp. per sq.in.

Consider the following items:

1. Volume of Iron.—The shell type with uniform fluxes has the maximum volume of iron—*i.e.*, 2250 cu.in.; the core-type with non-uniform flux has the least, or 1940 cu.in., while the multiple-magnetic-circuit and the core-type with uniform fluxes both have 2085 cu.in.

2. Volume of Copper.—The core type with uniform flux has the greatest copper volume—namely, 625 cu.in. —while the MMC (multiple-magnetic-circuit) has the least, at 534 cu.in.

3. Cost of Material.—The plain shell type has the highest cost, at 162.1; the plain core and the shell type with non-uniform flux follow with \$160.7 and \$156.7 respectively, while the core type with non-uniform flux and the MMC type seem to cost nearly the same, or \$148, which is approximately 8 per cent less than the plain shell-type.

4. Efficiency.—Efficiency at full load is highest for the MMC type, and lowest for the plain core type, the range being slight, however, from 98.47 to 98.30.

CONCLUSIONS

I. For any type of transformer the design for dimensions which will yield a given rating at the minimum cost for material is easily and quickly worked out, basing the design upon three ratio quantities, namely, z, the ratio of core section to coil section; x, the ratio of height of opening to width of opening, and y, the ratio of core depth to core width.

II. These ratios may be calculated by simple expressions involving $R = K_cC_c/K_iC_i$, or the ratio of space factors, copper and iron, times the ratio of costs per cubic inch, copper and iron. These figures should be in the possession of any one in commercial design.

III. The assumptions of flux and current densities permissible, together with the ratio factors, permit the quick determination of all dimensions and the calculation of weights, costs and efficiencies.

IV. Should the iron and copper losses not bear the desired ratio, this may be changed without modifying the dimensions of the transformer or affecting its cost, assuming that reasonable densities were assumed and no unusual ratio of losses is desired.

V. In an example used to compare the five usual types of single-phase distributing transformer highest efficiency and lowest cost point to the choice of the multi-magnetic-circuit transformer, with the core-type having unequal core and yoke areas as the second choice.

VI. It would seem that the method here outlined might profitably be extended to apply to polyphase transformers.

The writer is aware that the items considered in the choice of type for a given service and in the determination of the dimensions for a transformer of given type and specifications leave many practical considerations untouched, but he hopes by the presentation of this paper to bring about a more complete and frank discussion of these items.

Features of Mammoth Waterwheel Generator

Method of Construction Employed in One of the 32,500-Kva. Generators Which Are Being Built for the Niagara Falls Power Company—Conservation in Design and Highest Possible Efficiency Characterize This Unit

SELDOM has the problem of design of an important machine been put up to the designer with fewer restrictions or less interference on the part of the purchaser than in the case of the new Niagara Falls generators which are to be rated at 32,500 kva., 25 cycles and 12,000 volts. About all the customer specified was the highest efficiency consistent with other desirable and extremely important characteristics such as reliability. He insisted upon a generator which, in combination with its waterwheel, should give the highest efficiency that has yet been obtained in a hydraulic unit. No restrictions as to the kinds of material or weights of parts were placed upon the designer. The only restrictions were those involved in the problem itself, such as good mechanical construction in all of the parts and sufficient reactance to protect against the strains and stresses that are pretty sure to occur in the operation of large electric systems because of accidents of one kind or another, such as the breaking down of insulation, trouble on the distribution lines or mistakes in switching.

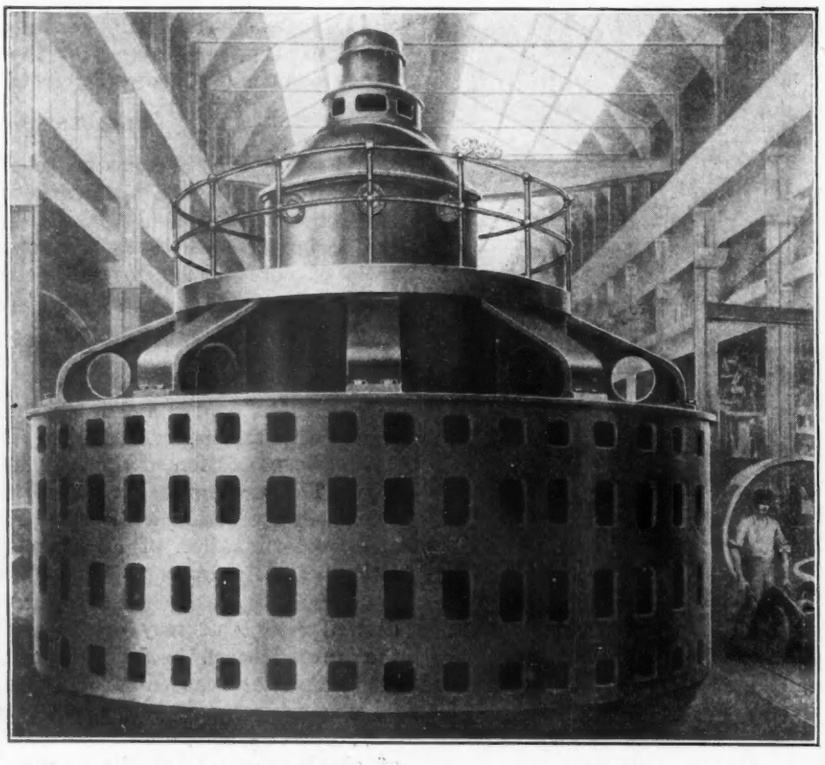


FIG. 1—ASSEMBLY OF NIAGARA FALLS GENERATOR RATED AT 32,500 KVA., 25 CYCLES AND 12,000 VOLTS

Three such units have been ordered—one from the General Electric Company, one from the Westinghouse Electric & Manufacturing Company and one from the Allis-Chalmers Manufacturing Company. The latter will make both the waterwheel and the corresponding generator, while the waterwheels for the other two generators will be made by the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company. Some of the features of the General Electric unit, as brought out by W. J. Foster of the alternating-current engineering department, will be recounted in this issue. Features of the other units will be described later.

Conservatism has characterized practically every feature of the design. The mechanical stresses allowed in the various parts, such as bearings, spider and rotor, are in many cases no higher than is sometimes allowed when using cast iron, whereas the best steel is being used. Because of the high efficiency that has been striven for relatively small losses will occur as the insulation will not be required to withstand abnormal temperatures. The guarantee to the customer is a 100-deg. C. machine at the rated output—32,500 kva. This is 5 deg. more conservative than the standard of the American Institute of Electrical Engineers for Class "A" or low-temperature insulation, whereas the insulation that has been used in the armature for both turn and external insulation is Class "B." This insulation, according to the A. I. E. E. standards, is suitable for 125 deg. The reactance of the generator is approximately 20 per cent, which permits the stator winding to be supported mechanically with unusually large factors of safety against the stresses produced by instantaneous short circuits. It is planned to determine the generator efficiency by using the input method, operating the generator as a synchronous motor and measuring the energy input by wattmeters. At the same time, certain losses like friction and windage and core losses will undoubtedly be determined by other methods, such as retardation, to check the accuracy of the input readings. The load losses will undoubtedly be checked by the calorimeter method; that is, by a determination of the temperature rise of the cooling air under various conditions of load, in which the excess of the heat losses as calculated in the cooling air over the combined segregated losses will be taken as the true load losses. A most careful determination will be made of the over-all efficiency of the unit as a whole, by measuring the water used and obtaining input from it, and taking the output from the switchboard instruments,.

One of the considerations arising in the early stages of the design was the selection of a diameter that would make possible a simple and mechanically strong rotor. It was quite evident that a rotor with a solid rim would

be better than one involving joints. Hence the diameter selected was determined by the possibilities of the shipment of the rotor. As shown in Fig. 2, the rotor spider consists of six wheels, each wheel a single casting of steel. The hubs are rabbeted into one another and are of such length that the rims lack a little of meeting one another, thus allowing space for the flow of air. The wheels were all cast from the same pattern except the

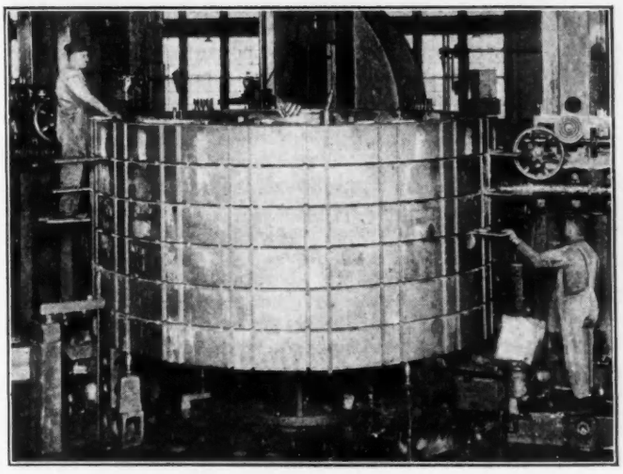


FIG. 2—CONSTRUCTION VIEW OF ROTOR SPIDER—SIX STEEL CASTINGS

one at the bottom, which had some stock added on the inside to furnish a surface for the brakes to act against. Two dovetails of the "T" type were machined for the attachment of each pole piece.

The construction of the field poles proper involved no particular difficulty, as it was not necessary to depart from standard construction. However, each pole piece is probably of greater weight than any heretofore built, the weight complete, without field winding, being 5000 lb. (2267 kg.). Copper strips wound on edge are used for the field coil in the usual manner, but they are larger than any yet wound for a commercial machine—so large, in fact, that they could not be formed upon the regular helix winding machines. The weight of the copper in each field coil is 1600 lb. (725 kg.).

The shaft extends a few inches below the stator frame and terminates in a solid flange machined to serve as a half coupling for attachment to shaft of the waterwheel. This flange is as close to the generator rotor spider as space for removal of the coupling bolts will allow. The upper end of the shaft is machined for a thrust collar which takes the entire weight of rotating parts and for a guide bearing which will be immediately below the thrust bearing. Only one other guide bearing will be provided, and that will be on the waterwheel. The shaft projects above the thrust bearing a sufficient distance to permit the lifting bale to be used to take the weight entirely off the thrust bearing; after this is done blocks may be inserted at twelve points around the circumference of the structure which carries the brakes. As soon as the thrust bearing is relieved of the weight of the rotor it may be dismantled, the bearings spider removed and the rotor lifted out.

Considerable thought was given to the appearance of the top of the unit. The bearings bracket, which serves as the supporting deck for the thrust bearing, is of cast steel in halves, with eight arms. The upper guide bearing is carried within this spider. The thrust bearing rests immediately on top of the spider, at which level is placed a circular platform and guard rail, access to which is obtained by a walk from the top of the operating gallery. Immediately above the thrust bearing are the collector rings, protected by a cage on which rests a dome that extends over the top of the revolving shaft, thus thoroughly protecting operators from any chance of injury.

The stator spider is in four parts, divided vertically. It is possible to assemble the laminations at the shops of the manufacturer building the core in halves or to ship the stator spider without the laminations and build up the core in the power house. There are advantages in building the core at the shops of the manufacturer, due to the facilities that exist there, which enable the work to be done in much shorter time. On the other hand, when the core is built at its destination the advantage is gained of obtaining a continuous rim and consequently one that does not have joints which sometimes make it difficult to arrange clamps capable of exerting sufficient pressure to prevent looseness and vibrations of laminations from developing. The slots are very deep, being of practically the same dimensions as those of the largest steam-turbine generators. The stator winding is of the common "barrel" type, assembled with two coil sides in a slot. Both the turn and external insulation consist of mica tape, and they are applied with the molding and compounding processes that have proved best for the largest turbo-generator coils.

The projecting ends of the winding at both top and bottom rest back against two solid steel rings that are carried by brackets attached to the heads of the stator. As shown in Fig. 4, these supporting rings are heavily insulated to form a seat for the coils. The individual coils are laced to the supporting bands by strong linen cord specially treated. The individual coils also have spacing blocks laced to their sides at short intervals, of

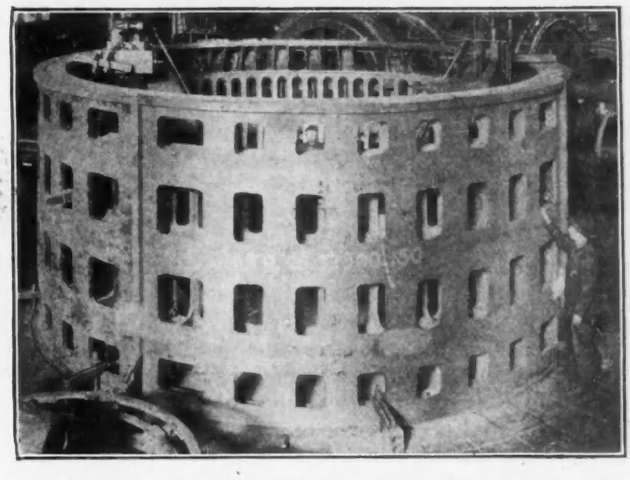


FIG. 3—TWO MACHINE TOOLS WORKING ON STATOR FRAME SIMULTANEOUSLY; RELATIVE SIZE INDICATED BY WORKMAN

such thickness as to make the completed winding perfectly ring-bound. This method of support has many advantages over the use of clamps placed on the inside of the winding that require bolts to pass through the winding, or the use of continuous metallic rings on the inside that may be expanded out so as to obtain sufficient clamping effect to keep themselves in place. A certain amount of flexibility to secure highly insulated

windings is of extreme importance. Such a method of securing end windings insures against the bruises and breaks in the insulation that are liable to occur where clamps are used that are harsh and unyielding when compared with the insulating material itself.

A great deal of thought was given by the engineers of the Niagara Falls Power Company to the general question of ventilation of the power house. In conferences with the designers of the generators a scheme was evolved by which the generators are designed to take in air at both the top and the bottom directly from the dynamo room and emit the air through the ventilation holes in the stator spider into a casing provided by the operating company. This casing is not circular in its external dimension but approximates the surface of a cylinder half way around the machine. This will be continued almost tangentially to the side of the operating gallery, which will run so as nearly to touch the side of the several generators.

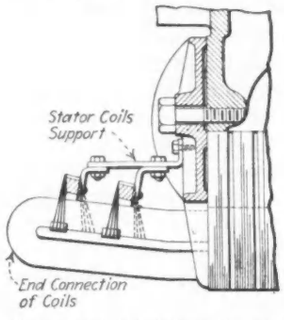


FIG. 4—METHOD OF BRACING PROJECTING END TURNS OF STATOR

In the outlet compartment underneath the operating gallery opposite each generator it is the intention to install a motor-driven fan to assist the circulation of the air—something which may prove necessary in the hottest weather. The air at the top of the machine will enter in a radial direction through screens underneath the operating platform that surrounds the thrust bearing. At the bottom the air will enter the machine from a pit underneath the generator into which two openings, in the form of stairways 90 deg. apart, connect with the dynamo room. From the warm-air compartments under the operating gallery the air may be passed out of doors or back into the dynamo room, as desired.

Fans are attached to both the upper and lower rims of the rotor at the outer edge. Housings to serve as baffles are provided at both top and bottom. They are of such design as to minimize eddies and effectively prevent the return of the air. Although fans are employed, they will simply assist in the ventilation, as the greater part of the air circulation will be caused by the rotor itself, the poles of which have unusual radial depth and consequently give large blower effect. The fan action of the rotor will be highly efficient because of the provision that has been made for the passage of a large quantity of air through the rotor rim.

Running Equipment Above Its Rated Capacity

One engineer in the East considers that the most important thing he has learned from his experience during the war is that generating equipment can be safely run over its full rated capacity when required. It is of course too early to say whether the plants suffered any extra depreciation on account of the heavy loads which were carried, but it would seem that they have not.

STATEMENT OF THE AIMS OF NEW ST. LOUIS BOARD

Organization Which Will Stand for Advancement of Electrical Industry in That City Announces Its Policy and Practice

The St. Louis Electrical Board of Trade is the name of an organization which is being formed to replace the local chapters of the Jovian Order as an instrument of local coöperation within the industry. The constitution and by-laws of this organization contain the statement of policy and practice which follows:

1. To create a spirit of mutual respect, esteem and cooperation between all branches of the electrical industry of St. Louis, with the view of systematizing and improving electrical practices as approached from the viewpoint of either the manufacturer, manufacturers' agent, wholesaler, retailer, consulting engineer, contractor, electric railway, electric light and power company, telegraph and telphone company, railroad or research laboratory, not only in the industrial and general electric field but in the home; such work to include the education of the people as to the benefits to be derived from the general use of electrical equipment, appliances and devices, from complete electrical wiring installations, from use of high-quality material and workmanship, from transaction of business only with competent and responsible people, and from placing business on the basis of advice rendered, ability to serve, quality and quanity of material installed, grade of workmanship and satisfaction to be derived from an electrical installation, machine or appliance.

2. To work for complete plans and definite specifications for all electrical installations and for expert supervision over all work to insure compliance with original plans and to secure a high grade of workmanship.

3. To secure full recognition of the desirability of healthy and prosperous public utilities, foster and promote the welfare, success and prosperity of such interests, encourage extension of public utilities as rapidly as the growing needs of the community require, and aid the utilities to secure a proper revenue, believing that the best interests of the community and the industry will be served thereby.

4. To keep closely in touch with all public matters pertaining to electrical problems, that all other business organizations and municipal, state and federal authorities may know that our organization is responsible and capable of handling intelligently subjects pertaining to electrical matters.

5. To assist in coördinating and systematizing "community advertising" among the various branches of the electrical industry, arranging for the necessary paticipation by the various branches of the industry both in the general scheme and the details which go with or follow after the main plan.

6. To take up problems having to do with desired readjustment of freight classifications for all electrical goods handled in the St. Louis market.

7. To interest itself in encouraging export shipments via all routes, including the river through New Orleans, and in accumulating the necessary information in regard to standards in use in South America and other foreign countries.

8. To maintain an information bureau as to any material and labor supply and demand which is of local interest.

9. To interest itself in the question of temporary or permanent exhibitions for the benefit of the electrical industry.

10. To provide weekly luncheon meetings for coöperative and educational purposes.

11. To interest itself in the matter of holding evening meetings when desirable for the purpose of discussing strictly trade subjects, both educational and coöperative.

12. To provide and equip proper headquarters and office force to serve the organization.

It is recommended that the aid of municipal, state and federal authorities be invited and that a manual of recommended practice be provided.

Electric Service in World's Largest Hotel—II

Provisions Were Necessary for Care of 2200 Rooms and Baths and for Feeding 6500 People—Complete Electric Laundry Installation Is of Special Interest, and Illumination of Bedrooms Is Unusually Good

THE problems involved in the selection of electrical energy supply, together with the general scheme of switchboards and distribution, for the Hotel Pennsylvania, New York, were discussed in the issue of May 10. In the present issue the signal and communication layout, which required making 10,000 connections, the large electrically operated laundry, elevator arrangements and ventilation are described. The illumination of bedrooms, commonly inadequate in even the best hotels, is unusually complete in this hotel.

Each of the bedrooms is provided with a center ceiling light controlled by a push-button switch near the door. These fixtures are of the semi-indirect type consisting of simple but attractive etched-glass bowls. Each fixture is equipped with a rather novel means for removing the bowl for the purpose of lamp renewals and cleaning. In addition to the ceiling fixture in each room there is a desk lamp supplied from a plug. Two other fixtures attached to the bureau are supplied from a second plug through a duplex cord, and a third plug is provided for supplying energy to a small fixture attached to the bed for reading purposes. In the bathroom a simple fixture is provided over the mirror above the wash basin. This is controlled by a pull switch in some cases, and in the larger bathrooms by a push-button switch near the door. In each of the bedroom closets a lamp is provided over the door, controlled by a pull-chain socket.

The service portions of the house are generally lighted by lamps with porcelain-enamel steel reflectors close to the ceiling, the object being to obtain fixtures requiring a minimum amount of cleaning. Metal reflectors are used to accomplish that purpose and also to avoid breakage. The lighting equipment in other portions of the hotel is shown in the accompanying illustrations.

All of the lighting panelboards in the hotel, of which there are about 240, are of the safety type. Each panel has two doors, one within the other. The inner door covers the switches for the various circuits, and every part that can be reached when this door is open is electrically "dead" so that it is impossible to get a shock when operating the switches. The fuses are under the second door, which is kept locked and can be opened only by an authorized electrician.

Signaling and Communication Systems.—In the design of the signaling system the object sought was to keep the installation as simple as possible, reducing the initial expenditure to a minimum and at the same time giving the guests every convenience which they expect in a modern hotel. As an instance of the simplification of design no push-button calls are provided from the bedrooms as the telephone is used entirely for transmitting the guests' desires and requirements. If the guest wants a page, a maid or valet, he uses the telephone and through the main switchboard a proper connection is made. If he wishes to order a meal, a telephone connection is made to a special order board, with separate operators, in the telephone room. These operators receive the order and make suggestions if the guests so desire, the order being sent by telautograph to the kitchen, floor clerk and floor-service pantry.

On each bedroom floor is a clerk who has pneumatic-tube connection with a tube station at the back of the main office and telautograph connection with the main room clerk, valet, porter, laundry, etc. On each bedroom floor is also a service pantry, in charge of a waiter

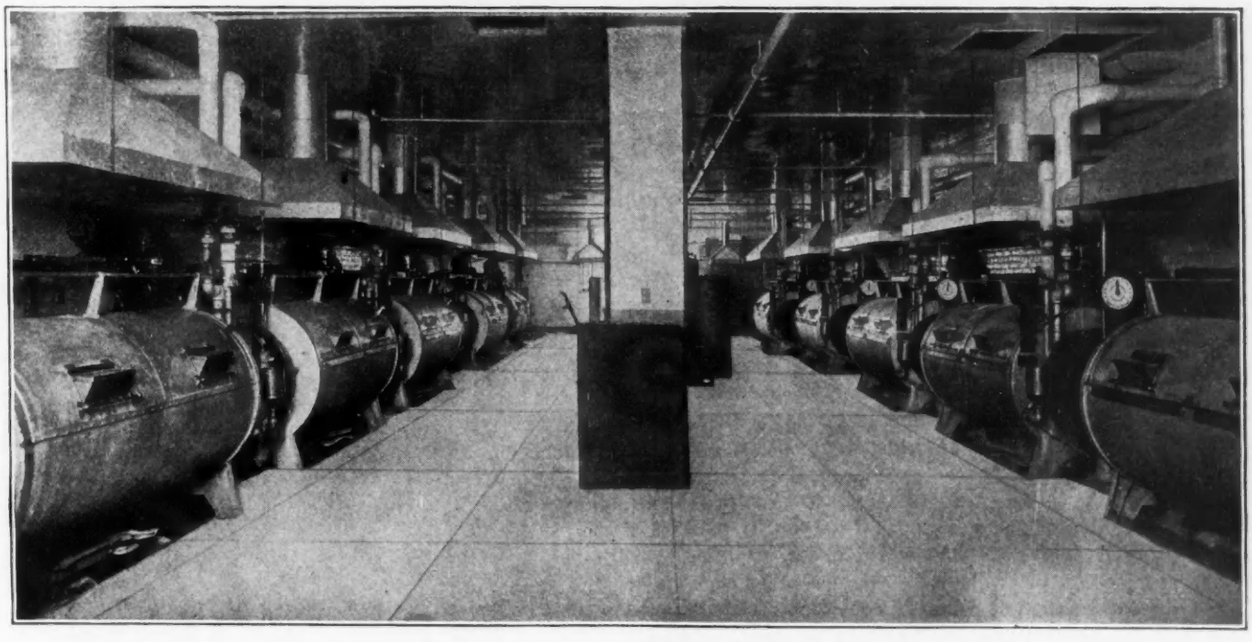


FIG. 1—VIEW OF LARGEST ELECTRIC LAUNDRY IN THE WORLD

and bus boys. These pantries are connected with the main kitchen pantry by a bank of six electrically operated dumbwaiters. Telautographs and a separate pneumatic-tube service are also part of the equipment of the service pantries. This pneumatic-tube service extends to the main kitchen on the basement floor. From the main office at the ground floor a system of pneumatic tubes connects with a number of stations throughout the hotel, including the bar, grill, roof, restaurant, etc.

Of the twenty-three positions on the main telephone switchboard, nine incoming positions are used for receiving messages from outside of the hotel. Two official positions are used for connections to the administration officers of the hotel, and twelve house positions are used for the guests' service, including the outgoing messages. The telautograph system is used for transmitting messages of all kinds left by visitors and for breakfast orders, etc., and therefore constitutes an important factor in the hotel.

The watchman's detector system is of the portable type; in addition there is a separate watchman's station on each floor connecting with an outside supervised service. The fire-alarm system is of the interior type connecting with the engine room. A single station on each floor connects directly through the National District Telegraph Company with fire headquarters.

An electric clock system is provided, including a clock in each elevator corridor, in the public rooms on the main floors and in some of the administration and service departments. This system is operated in connection with an electric time-stamp system, the time stamps being placed on the floor clerks' desks, in the service pantries, at the bell captain's headquarters and in other service portions of the house.

Elevator Equipment.—The main group of passenger elevators consists of two rows of six elevators each opening onto the passenger-elevator corridor. These elevators run from the basement to the roof floor. By putting all of the elevators in one group it was decided that better service to the guests would be provided because less confusion would result in finding the elevators. One set of six elevators may be run as local cars and the other set express. Two other elevators are installed at one corner of the building and serve to carry passengers from the tunnel connecting with the Pennsylvania Railroad station and the subway to the main floor. At one side of the building near the ballroom entrance are two other elevators for carrying passengers from the main floor to the ballroom floor.

For the service requirements of the hotel a bank of eight elevators is provided. These elevators run from the sub-basement to the roof and are arranged to be operated in three groups so far as signaling is concerned, thereby permitting a certain amount of flexibility in assigning the elevators to different purposes. For example, one pair of elevators may be used for waiters exclusively, another pair for baggage, laundry, and so forth. Three additional elevators in the rear of the building serve to carry supplies from the driveway to the lower floors and also to provide service between the sub-basement and the banquet-room kitchen, which is on the first mezzanine floor.

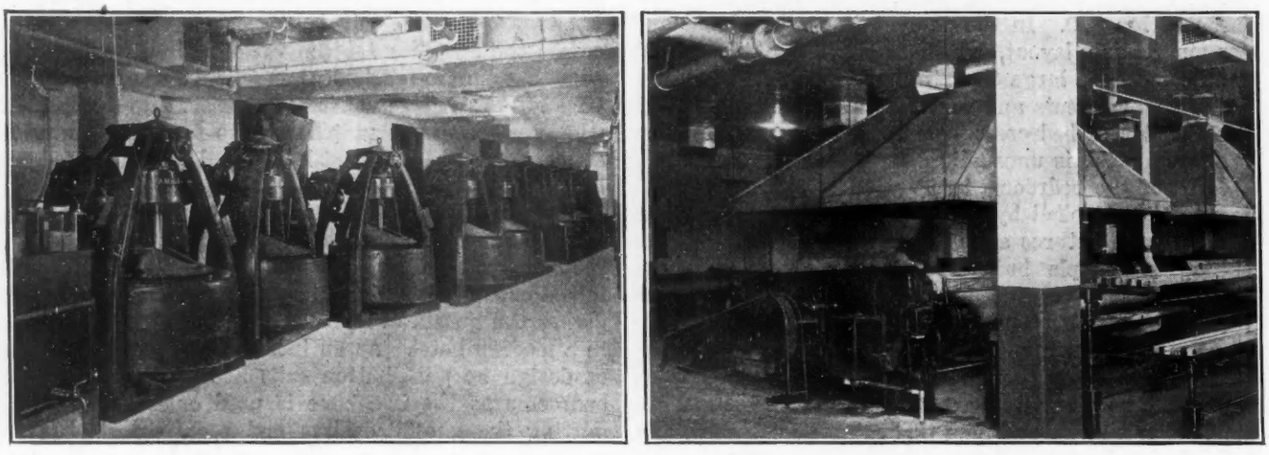


FIG. 2—DRYING AND IRONING MACHINES HAVE INDIVIDUAL MOTOR DRIVE

All of the passenger and service elevators, with the exception of one large service elevator, are of the one-to-one gearless-traction type running at 600 ft. (180 m.) per minute. The large service elevator, which is approximately 9 ft. wide by 7 ft. deep (3 m. by 2 m.), is of the worm-gear traction type running at 450 ft. (150 m.) per minute.

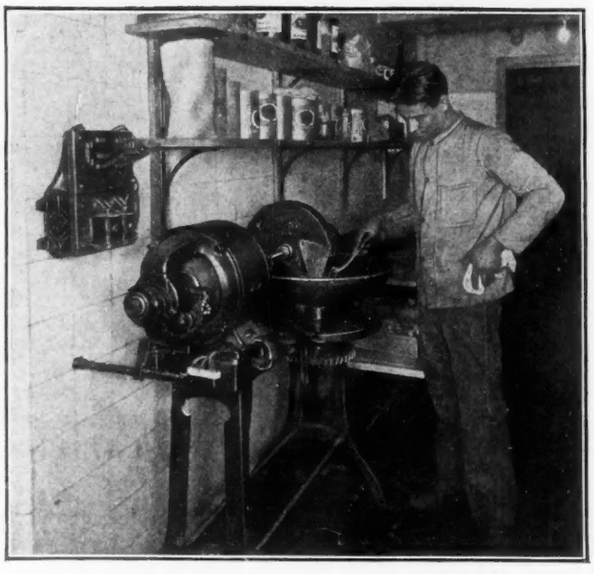


FIG. 3—THE KITCHEN ALSO HAS THE NECESSARY MOTOR EQUIPMENT

The signal system for the passenger elevators consists of up-and-down flashlight annunciators in each car

with push-buttons and up-and-down signal lanterns at the various landings. Dial indicators as well as tell-tale annunciators are placed on the ground floor for furnishing to the elevator starter the necessary information as to the location of cars and the car signals. On all passenger elevators a simple safety device is used to prevent the possibility of the car moving until both the hatchway door and the car gate are securely closed.

waiters to the various floors in accordance with demands or signals received from the various floors. These signals are indicated on an annunciator in the basement kitchen. The dumbwaiters run at a speed of 500 ft. (150 m.) per minute and are capable of carrying a load of 100 lb. (45 kg.).

Laundry Equipment.—It can be readily understood that this gigantic hotel, with 2200 rooms and baths and

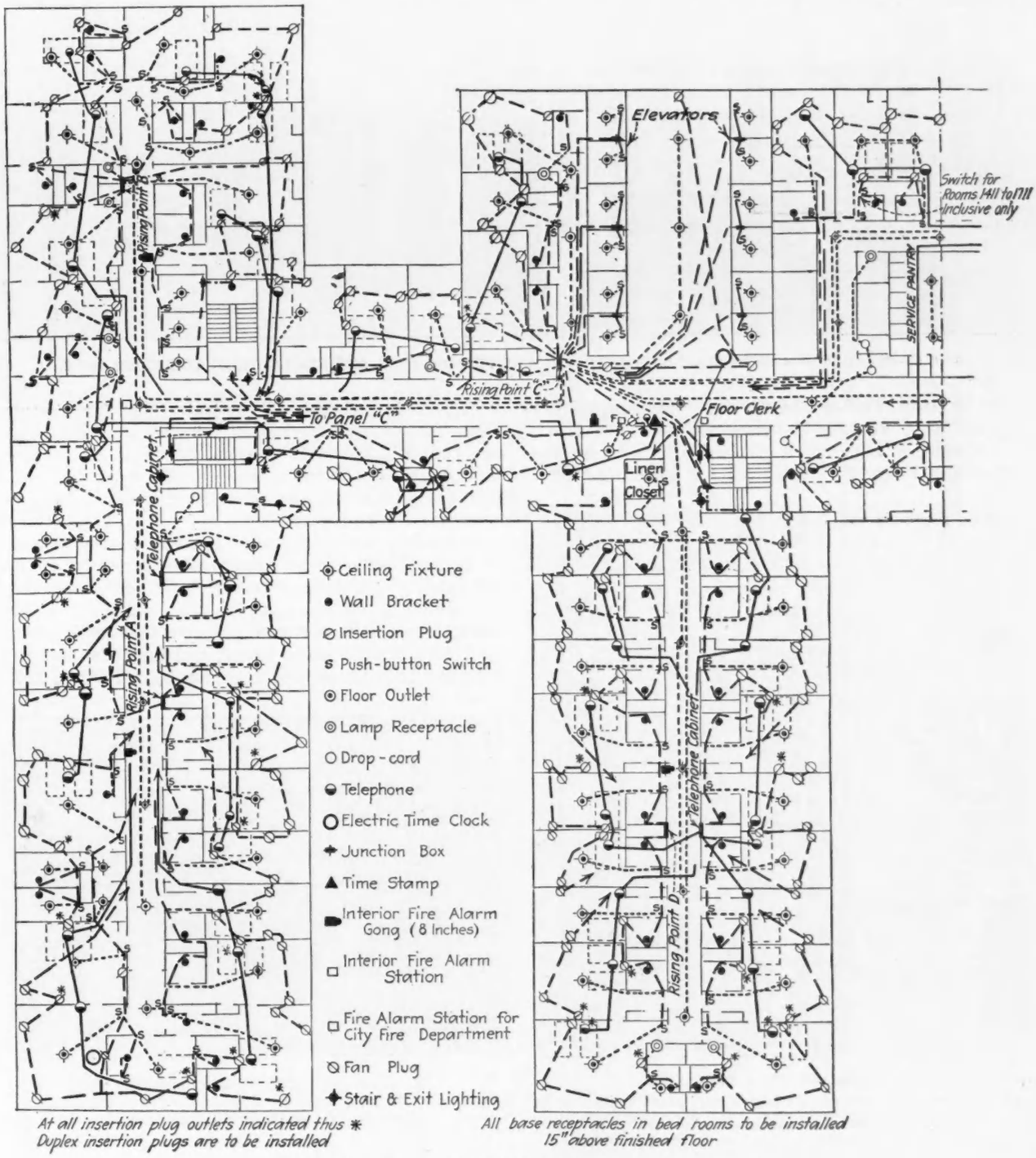


FIG. 4—DETAILS OF WIRING ON PORTION OF A GUEST-ROOM FLOOR

The six dumbwaiters previously mentioned for furnishing service between the kitchen and the various floor pantries are operated on the single-point control plan. That is, an operator in the basement kitchen controls the movement of the cars and dispatches the dumb-

facilities for feeding 6500 people, will have quantities of towels and bed and table linen to launder which will be measured in tons rather than pounds. To handle this enormous quantity the most modern and up-to-date laundry equipment has been installed, making the largest

electrically driven laundry in the world. The equipment includes ten 42-in. by 72-in. (100-cm. by 180-cm.) cascade metallic washers, which are driven by direct-connected reversing motors. Twelve 40-in. (100-cm.) overdriven centrifugal extractors dry the work, with the exception of bath towels, which are handled in three

Ventilating-Fan and Pump Motors.—The system of artificial ventilation used in the Hotel Pennsylvania is very complete. Pure filtered, washed and tempered air is blown into and the foul air is exhausted from practically all the concourse and service rooms in the lower floors and basements. All of the 2200 bathrooms are

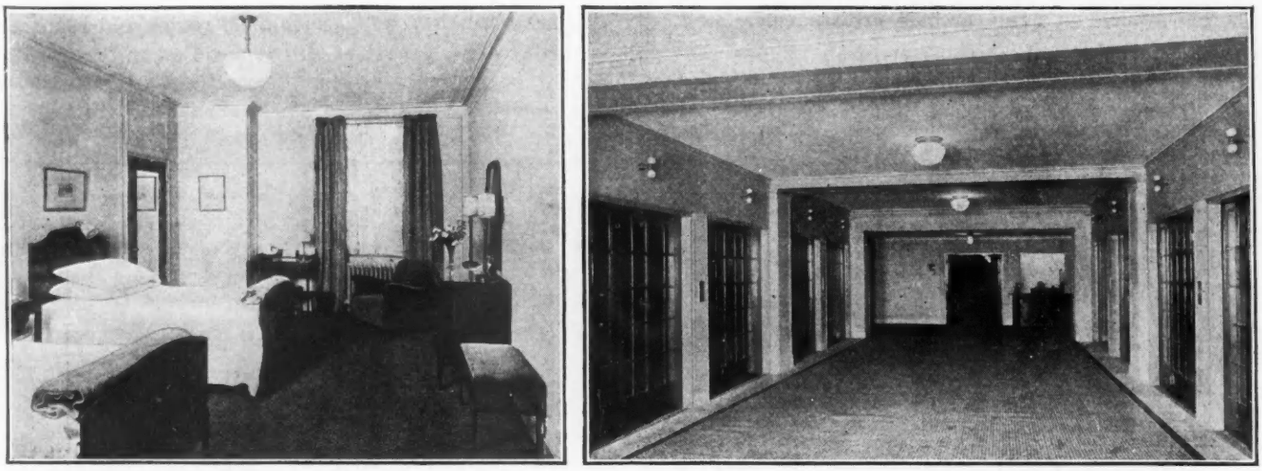


FIG. 5—GUEST-ROOM AND CORRIDOR LIGHTING; NOTE THE DRESSER, DESK AND BED LAMPS IN THE GUEST ROOM

40-in. by 94-in. (100-cm. by 240-cm.) steam-heated drying tumblers. Ironing is performed with five 120-in. cm.) flat-work ironers. A curtain drier and finisher and complete laundry equipment for handling guests'

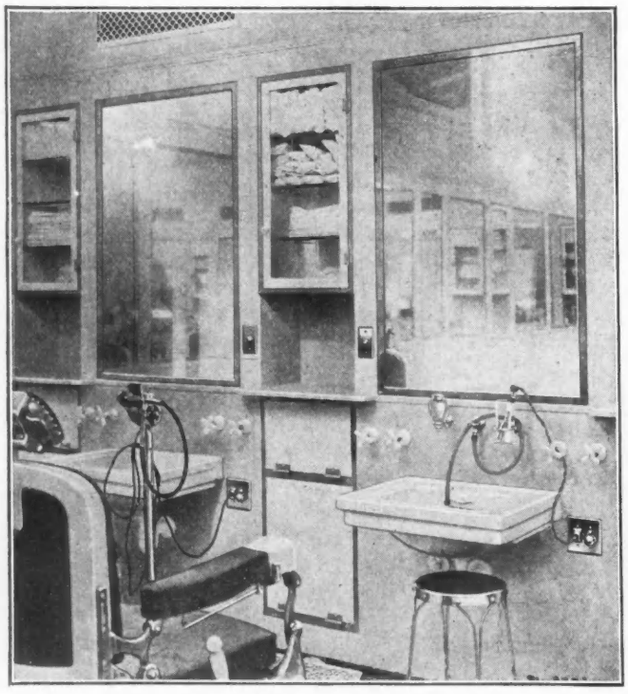


FIG. 6—BARBER-SHOP FACILITIES

Each chair of the barber shop has as part of its equipment an outlet for an electric hot-water sterilizer. The outlet is installed at the right of the water basin and is equipped with an indicating lamp which is lighted when the current is flowing through the heating coil. This outlet can also be employed for attaching massaging and similar appliances. A push-button for calling a bootblack or asking for electric appliances is available at each chair.

wearing apparel are also installed. Each machine is driven by its own motor, and panelboard control is used extensively. Although located in the sub-basement, this laundry is very comfortable as a working place because of the effective ventilating system provided.

ventilated by exhaust. To operate these fans twenty-seven motors, totaling nearly 700 hp., are used. They are run at low speeds (around 300 r.p.m.) to secure quiet operation. Each is quipped with a hand-operated field speed controller and has a speed range of from one to one and a half or two.

Two water tanks are provided, one on the eleventh floor and the other on the twenty-second, which are ordinarily supplied by means of steam pumps in winter and electric pumps in summer. The electric pump for the lower tank is a two-stage centrifugal unit driven by a 60 hp., 1600 r.p.m. motor, and that for the upper tank has four stages and is driven by a 100-hp., 1200-

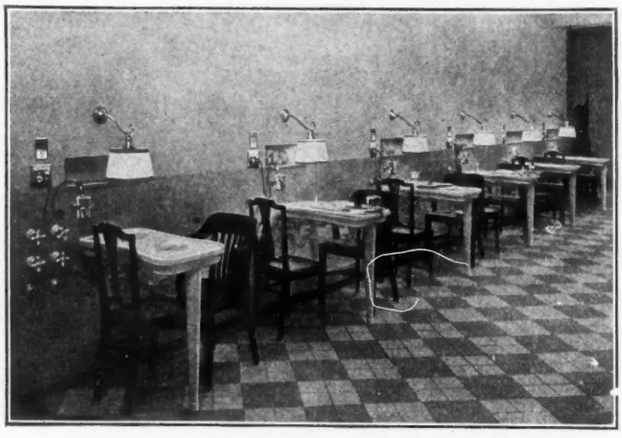


FIG. 7—MANICURING IS ALSO PROVIDED FOR

The men's manicuring parlor, adjoining the barber shop, is likewise equipped with a heater for sterilizing and a push-button for signaling purposes.

r.p.m. motor. Both are equipped with automatic float controllers.

Motor-driven pumps are also used for circulating refrigerated brine to 150 cold-boxes located throughout the hotel, for supplying each guest room with ice water, for circulating the brine in the freezing tank, and for emptying the sump at the lowest level of the hotel.

Two vacuum pumps, each operated by a 20-hp., 1750-r.p.m. motor, connect with 489 vacuum-cleaner outlets through the hotel. Each pump can operate thirty cleaners at once, producing the same vacuum whether one or all are in use. Motors are also used for operating the dish conveyors, potato peelers, meat choppers, cake mixers, ice cutters and other kitchen machines.

Electrical Construction Work.—Aside from the magnitude of the work of installing the electrical equipment, there were very few difficult problems presented in the electrical construction work, because the much-to-be-desired and seldom-realized elbow room for electrical work was here obtained. Hence the placing of about 635,000 ft. (195,000 m.) of conduit, 150 tons of wire and 30,000 outlets proceeded without a hitch. The equipment for the bell and telautograph systems was installed in such a way that with more than 10,000 original connections to be made the systems operated perfectly from the start and no reconnections were made. The greatest problem was to get the material to the job under war-time conditions.

PROPER SELECTION OF ARC-WELDING EQUIPMENT

Little Difference Found in Quality of Welds Made Under Various Processes—Results Depend Chiefly on Skill of the Operators

BY R. H. FENKHAUSEN
Electrical Engineer, San Francisco, Cal.

The selection of arc-welding equipment is influenced more by considerations of first cost and local conditions than by any question of the quality of the work performed. Experience shows conclusively that successful welding lies 75 per cent in the skill of the operator and only 15 per cent in the apparatus used. A properly trained welder can do excellent work with a water-barrel resistance connected to a 220-volt or 550-volt direct-current shop power circuit, whereas the finest type of constant-energy arc-welding equipment in the market will not even give fair results in the hands of a man who has not had proper training. This statement should not be construed as a recommendation for the use of water barrels or other forms of resistance to reduce the voltage of 220-volt or 550-volt direct-current power circuits for welding purposes. It is intended, rather, to drive home the very important fact that the welder and not the equipment is the most important factor in the welding process.

Welding equipment may be broadly divided into three classes—constant potential, direct current; constant energy, direct current, and alternating current. There should be little if any difference in the quality of work done, under proper conditions, by these several types. In selecting the equipment choice will be influenced primarily by first cost and by local conditions, such as the number of arcs used in the plant, the type of current available and the density of welding operations within a given area.

Constant-Potential Direct-Current System.—The constant-potential direct-current system is the oldest and simplest arc-welding system known. The apparatus required is limited to a resistance sufficient to absorb the difference between the line voltage and the necessary 21 volts across the arc. The source of power should preferably be a direct-current generator wound for 60 volts to 75 volts. Any higher voltage results not only in decreased efficiency but also in greater liability of burning the metal. Even at 60 volts the resistance losses are almost two-thirds of the total current energy consumption, but where the cost of energy is at all reasonable the low efficiency is more than offset by the increased reliability and low maintenance cost of the apparatus. The use of a voltage less than 60 is not advisable, as experience has shown that at least 60 volts is necessary to strike an arc properly, especially in overhead work.

This system is suitable for use where a comparatively large number of welders are employed within a restricted district and where the transmission at 70 volts will not lead to a prohibitive copper cost. A large central generator can be used at the load center of the system or several smaller generators can be installed at various points. The use of a large number of small generating sets is not recommended, however, as this offsets the low maintenance cost which is one of the principal advantages of the constant-potential system.

Constant-Energy Direct-Current System.—The constant-energy direct-current system employs small one-man motor-generator or balancer sets which can be mounted on small portable trucks and easily drawn from place to place as required. The motor-generators are suitable for operation on alternating-current power circuits of any voltage, phase or frequency, and the balancers are used upon 110-volt direct-current circuits or between the grounded neutral and the positive wire of the 110-volt and 220-volt Edison three-wire system.

The field for the constant-energy system is where the number of arcs required will be relatively small in number, scattered over a comparatively large area, or where considerable moving from place to place is required. The efficiency of this system is very high. In fact, it is the most efficient welding system available at the present writing. The equipment, however, is more or less complicated, subject to high maintenance costs and to more or less labor expense in moving from place to place when necessary. It should not be used where a large number of welders are confined to a very small space.

Alternating-Current System.—The alternating-current system employs special transformers usually having a high leakage reactance. Many types of this equipment which have been placed on the market differ only in minor characteristics of energy control. The efficiency of the alternating-current system is fair but its power factor is very poor. As regards its operation it will be found that with an expert welder and under very favorable conditions the work done with alternating current can be made to equal that done with direct current. It is a fact, however, that the average welder used to direct current will experience great difficulty in welding with alternating current.

In conclusion, it may be stated that the constant-potential 70-volt direct-current system is the best system for use where welding operations are to be carried on on a large scale, as in a shipyard, where a large number of arcs per ship would be employed. The constant-energy direct-current system should be used under all other conditions, except on special jobs where the lack of direct-current facilities renders the use of alternating current advisable. In the selection of welding equipment it should be remembered that low maintenance goes with low efficiency, and high maintenance costs may be expected with high-efficiency apparatus.

A League to Enforce Industrial Peace

We Cannot Return to the Pre-War Harassing Hostility Between Employers and Employed, and the Labor Problem Must Be Solved in a Comprehensive Way to Assure Continuity of Production

BY L. K. COMSTOCK
L. K. Comstock & Company

Mr. Comstock deals here with the entire problem of readjustment of relations with labor. The labor problem touches all industries. Mr. Comstock's discussion is of particular interest to the electrical industry because of his close connection with and understanding of the conditions under which it operates.

THE whole world, and in particular the industrial world, is undergoing readjustment and reconstruction. The process began before the close of the war, but has been greatly accelerated since, partly because men's minds have been pried open by the facts and jolts of the war and are therefore more receptive to new ideas than formerly, and partly because the fear of Bolshevism, a thing but imperfectly understood in America, is driving men to take preventive measures against ills they know not of. Men of the industrial world are striving toward the realization of ideals formerly considered unattainable and hence impracticable. Men who are called practical worship the god of things as they are and do not sense the great fact that the world marches on irresistibly, changing the practical man of to-day into the back number of to-morrow and the idealist of to-day into the practical man of to-morrow.

He who senses the movement, the inexorable movement of the human world, and lives a life of eternal adjustment and readjustment, is the man who is constantly realizing ideals and hence may be called the practical idealist. The world moves, and men either move with it or are left behind. The tremendous event of the war will not leave the world as it found it. Social and economic institutions, deep-rooted and ancient though they be, must undergo change if they block the path of the highest attainable level of social justice and the widest extension of opportunity, welfare and industrial contentment.

REFORMS ARE DEMANDED BY THE TIMES

The spirit of a new day justly demands reforms, and those who obstruct and stubbornly resist them will be the derelicts left behind. The world moves on in endless cycles, because man by nature is an adventurer and none who does not adventure is likely to stumble on the facts in the realms of science, of law, of medicine, of industry and of politics. The stay-at-homes are the conservatives, who like things as they are, who abhor change, in a world of kaleidoscopic aspect.

The history of the world is the story of adventure, over lands and seas, real continents of land and real seas of water, but more often seas of scientific doubt and continents of intellectual challenge. War stirs the intellect and the heart to their very depths, and readjustment is the result of these stirrings. Readjustment causes adventure, and the sharpened edge of adventure quickens the mind to sense the inequalities, injustice, inappropriateness and inadequacies of things as they are, and it reaches out toward change when once the necessity of change becomes obvious to the quickened mind.

A change of attitude toward labor, whether organized or unorganized, is foreshadowed by the events of the past four years. The industrial world in small units and in large units, but all disconnected, disjointed and without unity of thought or action, has been struggling with the problem of labor. The struggle, though successful in isolated cases—like the Steel Corporation and the Colorado Fuel & Iron Company—has been generally carried on without clear thought of the future and without any clear idea of coöperation with labor, but rather with the idea of maintaining the existing status, rectifying here and there minor abuses and differences of opinion, conceding as little as possible, and as infrequently as possible, anything in the way of wages.

PROBLEM HAS NOT BEEN WHOLLY GRASPED

There does not seem to have been a comprehension of the breadth and stature of the general problem, or any broadly concerted action looking toward a general solution. Most employers and employees seem to have naturally drifted into opposing camps, whose daily existence consists of forays, patrol raids, skirmishes, and now and then pitched battles, without ever an approach to a general engagement. The captains of the employers of labor can scarcely be said to have realized that in the last analysis their interests are hard to differentiate from the interests of labor, and the same is true of the leaders of labor—they have seldom appreciated that those whom they led were generally better off if their struggles could be carried on without undue cessation of work and its consequent penalties.

The problem of labor can and must be solved in a comprehensive way. The industrial world cannot go on indefinitely with the great problem of labor unsolved, baffling the feeble attempts of unorganized thinking, continually shifting ground, with employers sporadically and in isolated places conceding bit by bit what labor, perhaps rightfully, often unjustly, demands. This is the great task confronting American business to-day. There can be no handwriting on the wall clearer than that which reads: "We cannot return to the pre-war competitive methods, business sabotage, down-pulling and harassing hostility between employers and employed, between organized industry and the government."

May it not be possible that the development of the control of industry shall in its general outlines follow the development of political control? The common people of England before the time of Simon de Montfort had no voice in the government. The king, nobility and the church were the sole repositories of political power. But when De Montfort, a patriot in advance of his age, calling the common people about him, overthrew Henry III (in 1265) he established what has since been known

as the House of Commons. The development of the political power of the Commons down to the present time is a story of intense interest, known to all the world.

In the development of government in industry may it not be said that we are now in a transition period somewhat resembling that of government within the state in the reign of Edward I? Here and there far-seeing employers—De Montforts of industry, after a fashion of speaking—are summoning to their councils representatives of labor and the community, as well as of capital and management.

In the struggle for a wider freedom, mankind will not rest until in industry, as in the state, autocratic government, whatever its form, is superseded by a form of government representative of all the parties in interest and ultimately by a system the corner stone of which is responsible self-government.

There is a growing consciousness permeating all strata of society that the war was fought, somehow or other, for the sake of democracy. Democracy free, democracy intelligent, democracy conscientious, is only coöperation, and real coöperation between capital and labor means a juster recognition of the part played by labor in the development of the modern world.

The Four Factors of Modern Industrialism

The modern industrial world consists of four parts —labor, capital, management and community. By the joint coöperation of all four industry is carried on and wealth produced. The reward of labor's contribution is wages; interest is the reward of capital's contribution; salary the reward of management and direction, and the community receives its reward in increase of quantity, or improvement in quality, in exchange for its large purchasing power.

These four parts are so intimately related that it would seem to be utter folly to abandon them to function in opposition. A well-ordered industrial society will accord a certain place and assign definite functions to each of the four chief members, and there must be lodged somewhere the requisite authority to execute these assignments of function.

Failure of labor to continue the processes of production, because of disinclination on the part of capital to meet a demand, would be a case in point; or the failure on the part of capital to meet a just demand on the part of labor for an advance in wages or an amelioration in working conditions would be another case in point. Any failure on the part of management properly to represent capital to labor or labor to capital, or interference in any way with close coöperation between capital and labor, would also be a case in point. The failure on the part of labor and capital to meet the just requirements of the community by decreasing definite production requirement, whether by studied inefficiency or cessation of work, would be a case in point.

Government regulation as a principle has been accepted. Government regulation has been applied to banking, railroading, telephone and telegraph, public utilities and trade relations.

In these days when men's minds have been attuned to leagues, leagues to enforce peace, leagues of nations, why not give some thought to a league to enforce industrial peace?

As a foundation upon which to build let us formulate a legislative program concerning private industry which shall rest upon the following propositions, on the legal principle of conserving the public (and industrial) welfare:

I. CLEAR RECOGNITION OF THE MORAL AND LEGAL RIGHT OF MEN TO ORGANIZE

This is paralleled by the first paragraph of a declaration of principles submitted by the War Labor Conference Board, signed by all members of the War Labor Board and indorsed by presidential proclamation April 8, 1918, reading as follows:

"The right of workers to organize in trade unions and to bargain collectively through chosen representatives is recognized and affirmed. This right shall not be denied, abridged or interfered with by the employers in any manner whatsoever."

II. THE ESTABLISHMENT OF TRIBUNALS, UNDER THE LAW, WHOSE MEMBERSHIP SHALL BE REPRESENTATIVE OF EMPLOYERS, EMPLOYEES AND THE PUBLIC

In its fundamental characteristics, this proposition is similar to the following paragraph taken from an agreement signed on Jan. 19, 1917, by the Secretary of War and Samuel Gompers, president of the American Federation of Labor, and reads as follows:

"For the adjustment and control of wages, hours and conditions of labor, in the construction of cantonments, there shall be created an adjustment commission of three persons, appointed by the Secretary of War, one to represent the army, one the public and one labor."

The fundamental idea underlying the various agreements entered into between the government and labor unions, or agencies performing government work and labor unions, is prevention of cessation of production and insurance of maximum production—two things which are quite as necessary under post-war conditions as during war, in order to meet successfully world competition. The war, however, created a set of conditions which made imperative these obvious remedies.

III. THE ESTABLISHMENT OF MACHINERY TO COLLECT DATA FOR THE USE OF SUCH TRIBUNALS IN DETERMINING FAIR AND REASONABLE WAGES AND FAIR AND REASONABLE WORKING CONDITIONS

This proposition is similar in character to the Bureau of Labor Statistics, whose function is to acquire and diffuse useful information on subjects connected with labor's relations with capital, hours of work, wages and earnings, and prices of food and commodities.

IV. THE CLEAR RECOGNITION OF THE JUSTICE AND NECESSITY FOR EFFICIENCY AND DISCIPLINE IN ALL INDUSTRIAL UNITS

This proposition finds its counterpart in the following paragraph quoted from the declaration of principles submitted by the War Labor Conference Board above quoted:

"The maximum production of all war industries should be maintained and methods of work and operation on the part of employers or workers which operate to delay or limit production, or which have a tendency to arbitrarily increase the cost thereof, should be discouraged."

V. EVERY WORKER TO BE GUARANTEED THE OPPORTUNITY TO SECURE REDRESS FROM ARBITRARY OR OPPRESSIVE EXERCISE OF HIS EMPLOYER'S FUNCTIONS

No defense is needed of this proposition, since all will agree that redress from arbitrary or oppressive laws and customs is an ancient right, inherent in the genius and institutions of the Anglo-Saxon race.

VI. EVERY EMPLOYER TO BE GUARANTEED THE OPPORTUNITY TO SECURE REDRESS FROM ARBITRARY OR OPPRESSIVE EXERCISE OF POWER BY LABOR

What is true of Proposition V is also true of Proposition VI.

VII. PUBLIC REGISTRATION OF ALL COLLECTIVE AGREEMENTS

With respect to this proposition, it may be said that such registration with a legally constituted department of the

government will have a deterrent effect on the making of improper and unlawful agreements between employer and employ

VIII. A NATIONAL COUNCIL, WITHOUT WHOSE SANCTION THERE WILL BE NO CONCERTED CESSATION OF WORK OR CLOSING DOWN OF PLANTS, TO WHICH ANY INTERESTED PARTY MAY APPLY FOR RELIEF, AS IT MAY IN PUBLIC SERVICE MATTERS TO THE INTERSTATE COMMERCE COMMISSION OR THE PUBLIC SERVICE COMMISSIONS OR IN TRADE MATTERS TO THE FEDERAL TRADE COMMISSIO

This is a development of the idea involved in the War Labor Policies Board. During the war the President appointed the Secretary of Labor to act as War Labor Administrator, and the Secretary of Labor, Mr. Wilson, exercised this power in large measure through Felix Frankfurter, chairman of the War Labor Policies Board. In actual fact, the Secretary of Labor not only acted in his normal capacity as Secretary of Labor, but also exercised extraordinary prerogatives as Director of Emergency Policies. Here again the war was responsible for the creation of a perfectly obvious remedial agency, although it lacked the breadth and scope intended for a national council.

IX. SUCH NATIONAL COUNCIL TO BE CONSTITUTED OF MEMBERS ELECTED FROM GROUPS OF EMPLOYERS AND GROUPS OF WORKERS AND REPRESENTATIVES OF THE PUBL'

This requires the national council to be made up of members drawn from employers, employees and the public. There can be little question about the propriety of both employers and employees sitting on such a council. There may be some question in regard to the membership being made representative of the public also. The public, however, in the opinion of most students of the industrial situation, is quite as much concerned in the matter of continuous production as either employer or employee, and ought to be represented wherever the relations of employer and employee are under consideration. To show that this policy has already received governmental sanction it is only necessary to mention the composition of the national War Labor Board, which consists of William Howard Taft, Frederick Judson, Frank P. Walsh and William Harmon Black, who were intended to be and are representative of the public, and in addition nine men representing employers and ten men representing workers. One of the latter died, leaving but nine on the board.

X. CLEAR RECOGNITION OF THE FUNCTION ON THE PART OF THE NATIONAL COUNCIL TO DETERMINE THE DEFINITION OF A REASONABLE WAGE AND REASONABLE WORKING CONDITIONS

This is only a forward step and development of the declaration of principles laid down for the guidance of the National War Labor Board. This board cannot properly function without determining the definition of a "reasonable wage and reasonable working conditions." It can settle neither wage disputes nor controversial matters in connection with working conditions without being able to determine and define reasonable conditions.

XI. CLEAR ACCEPTANCE OF THE PROPOSITION THAT, ADEQUATE MACHINERY BEING ESTABLISHED FOR THE REDRESS OF ALL JUST GRIEVANCES, THE RIGHT TO COERCE BY STRIKE OR LOCKOUT IN ALL SERVICE AFFECTING PUBLIC HEALTH, SAFETY, CONVENIENCE OR ECONOMY SHALL BE MADE AS OBSOLETE AS THE DUEL OR AS ILLEGAL AS LYNCHING OR MURDER

The above proposition is clearly foreshadowed by all the acts of the government during the war pertaining to the elimination of labor disputes.

XII. ACCEPTANCE OF THE PRINCIPLE OF DELEGATION OF ORDINARY POWERS BY THE NATIONAL COUNCIL TO LOCAL BODIES, DULY AUTHORIZED AND CONSTITUTED, FOR THE PURPOSE OF DEALING WITH LOCAL, AS DISTINGUISHED FROM NATIONAL, QUESTIONS, IN THE INTEREST OF SPEED, ECONOMY AND EFFICIENCY

Delegation of powers in well-defined districts would seem desirable where no national question is involved. A local council under this plan could be composed of those whose understanding of local questions and conditions would contribute to speed, accuracy and justice in decisions, and would afford a reasonable measure of local self-government. Acting under the control of the national council, the decisions of a local council would follow the general lines laid down by the national council, and thereby a unity in industrial policy would result.

The foregoing twelve propositions, representing nothing new or radical, if duly and properly enacted into law, would create a simplified piece of machinery for regulating industrial affairs, whereas during the war the machinery was complex, lacking unity of action and in many cases the power to enforce decisions. Many of the governmental departments during the war adopted their own labor policies, which placed the government as a whole in the untenable position of enunciating conflicting views and decisions with reference to labor disputes, and a number of these disputes finally reached the President for decision. Machinery should be set up which would render it unnecessary for a labor dispute ever to reach the President; but such disputes should be decided by tribunals composed of experts, who, when necessary, may call upon properly constituted departments for facts and data pertaining to the case before them.

It is doubtless necessary to meet the objection that such a plan argues too much eighteenth-century governmental interference with the industrial world—too much governmental interference with too little governmental efficiency. That this objection has force must be admitted; but, on the other hand, it must be argued that governmental interference is the price we pay for liberty—that self-imposed restraint free men call liberty. To decry governmental ownership, regulation or control because of the too obvious inefficiencies of our present legislative and administrative systems is merely begging the question and will not meet the situation.

We must amend, change or brush away those parts of our present eighteenth-century governmental system which stand in the way of a modern twentieth-century solution of our industrial problems if we are to succeed in world industrial competition; and if success shall attend our efforts, we shall have to stop business buccaneering, fleecing the public and resistance to the legitimate demands of labor for generally better standards of living. Meeting these situations from day to day as we see them is evolution; continued resistance to them will bring revolution.

This plan differs from the industrial council plan reported by the Whitley committee to the British government in the following important respects:

(a) This memorandum contemplates enactment of a plan into law *in toto*, at once, whereas the Whitley plan contemplates voluntary individual trade and labor organizations acting jointly in recommending to Parliament from time to time such legislation as seems desirable. To quote from the Whitley report:

"According to most recent advices, the English Ministry of Labor has already been successful in setting up national councils in fifteen industries, including pottery, building, rubber, gold and silver trades, matches, silk, furniture, chemical trade, baking, vehicle building, china, clay, hosiery, paint and varnish, and leather goods; and organization is under way in at least half a dozen more. In other words, the documents here brought together relate to a going and active movement, one whose extension and development is assured."

(b) The public does not appear to be directly represented in any of the trade councils under the Whitley plan, whereas under this plan the public is represented equally with employer and employed.

(c) The plan here exhibited would undoubtedly work most effectively if all employers were organized by trades or occupations and all employees similarly organized, but the plan should work quite regardless of the degree of organization accomplished. The Whitley plan, on the other hand, seems to depend for its effective workability on complete organization. In this connection the following paragraph, quoted from the Whitley report, is instructive:

"It may be desirable to state here our considered opinion that an essential condition of securing a permanent improvement in the relations between employer and employed is that there should be adequate organization on the part of both employers and workpeople. The proposals outlined for joint coöperation throughout the several industries depend for their ultimate success upon there being such organization on both sides, and such organization is necessary also to provide means whereby the arrangements and agreements made for the industry may be effectively carried out."

This memorandum is not intended to do more than suggest in merest outline a plan to simplify and unify the relations that exist between employer, employee and the public.

This, or some other plan having for its object the legalizing of relations between employer and employed, the stabilizing of conditions and the consequent assurance of continuity of the processes of production, ought to make an instant appeal to the employer who is a business man. It ought to appeal with even greater force to large corporations, the cessation of whose production is even more serious, on account of the quantity involved and the great inconvenience, injustice and general detriment to the public.

Such a plan ought to appeal to the public because by its terms the public is a part of the council and can make a direct appeal to the council whenever its interests are in jeopardy.

The plan ought to appeal to organized labor because labor's status becomes legalized, and therefore definite, and a body of precedent and common law of labor could in time be built up which would establish the relations of employer, employee and the community on foundations of principle, justice, morality and fair dealing which not even the most enthusiastic protagonist of either side of the great question would have the hardihood to claim exists at the present time.

Nothing in the plan contemplates the abolition of existing organizations of either employees or employers, but the plan taken as a whole offers the industrial world a court of last resort; therefore labor delegates, business agents, trade boards, boards of governors and executive committees of employers' associations may continue to function and enjoy all the prerogatives, duties and emoluments to which they have heretofore justly been entitled.

Industrial Maintenance and Rehabilitation Methods

Great Saving Effected by Standardization of Methods and Materials—Arguments for the Use of 115 Volts Direct Current Supply Instead of 230 Volts—Functions of Storage Battery in Industrial Plants Are Clearly Stated

BY E. E. GEORGE
Electrical Engineer, Chicago, Ill.

DURING the last three years the Lodge & Shipley Machine Tool Company of Cincinnati, Ohio, has made a particular effort to standardize its electrical and mechanical maintenance methods and its mill supplies. While the chief object has been to reduce the length and the number of shutdowns of productive equipment, some detailed results were:

(1) A virtual rehabilitation of the electrical system, causing it to do more than comply with the latest code requirements.

(2) A reduction of the number of extra parts and operating supplies to about 30 per cent of the number formerly necessary.

(3) An increase in the size of purchase orders for maintenance material, which permitted standard package discounts, with an average saving of 20 per cent.

(4) The accumulation of a number of spare units available for quickly replacing inoperative equipment.

(5) A reduction in the time required for training helpers to become proficient in maintenance work.

(6) A 50 per cent reduction in the labor of keeping a perpetual inventory of plant equipment.

(7) The introduction of prints and records of all wiring and piping layouts.

(8) Ordering of all material and the scheduling of all machining operations for a maintenance or construction job beforehand, with as great a degree of accuracy as on new production work.

(9) The development of several new devices and fittings, built in the company's own shops or added by electrical manufacturers to their lines.

CHOICE OF DIRECT-CURRENT VOLTAGE

The first steps toward the standardization of electrical equipment were to purchase outside power and to install a new switchboard. A 300-kw. synchronous motor, supplied with 4400-volt, three-phase, 60-cycle current from the Union Gas & Electric Company's primary lines, directly connected to a 115-volt direct-current generator, was substituted for steam-driven generators.

While there was no question regarding the desirability of 440-volt, three-phase, 60-cycle induction motors for all constant-speed line shafts and individual motor-drive machines requiring less than 100 hp. each (4400-volt synchronous motors being chosen for any future installation of air-compressing or other equipment of 100 hp. or larger), there was a wide disagreement regarding the voltage for the direct-current equipment. The representatives of the electrical manufacturing companies insisted that 230 volts was the standard for direct-current industrial motors and with difficulty were induced to bid on a 115-volt direct-current generator.

The following arguments for 115-volt direct-current distribution in place of 230-volt were advanced by the purchaser's engineer:

(1) That 230-volt motors are standard only because manufacturers have insisted on discouraging the design, manufacture and sale of 115-volt equipment.

(2) That the two-wire and three-wire, 230-volt systems were developed for city distribution before the long, heavily loaded direct-current networks were superseded by alternating-current distribution with regulated feeders, and that such conditions do not apply in modern plants.

(3) That any three-wire system involves an unnecessary complication of wiring and of switchboard construction.

(4) That wherever alternating-current power is available direct current is used only for variable-speed motors, battery charging or electromagnet equipment, and that in modern industrial plants this load is a small proportion of the total (owing to the development of quick-change gearing for machine tools, which the writer considers superior to the variable-speed motor drive). High-voltage alternating-current power may be carried to a central point, converted into 115 volts direct current by a motor-generator set and distributed to the

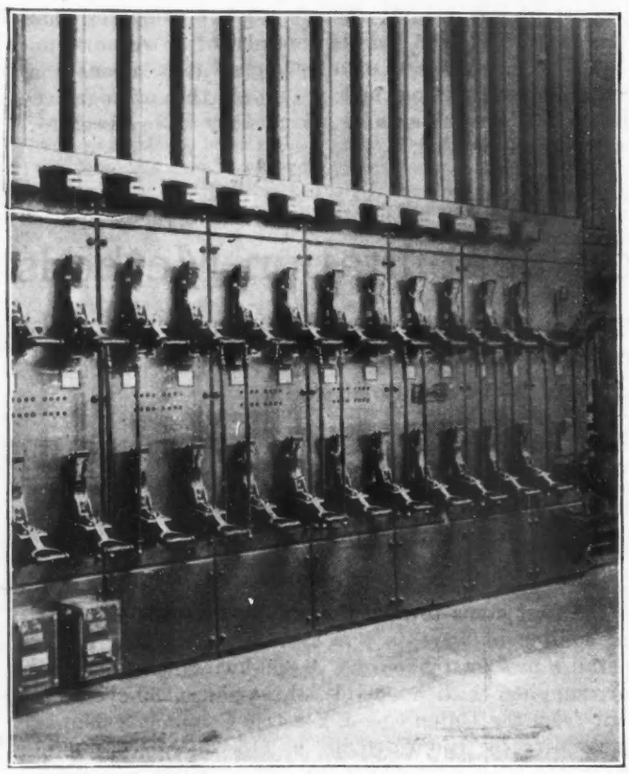


FIG. 1—CIRCUIT BREAKERS USED INSTEAD OF KNIFE SWITCHES

cranes, storage batteries, lifting magnets, arc welders, reversing planers, etc., with a copper expenditure for direct current which is very small compared with the cost of copper for alternating-current power or with the cost of direct-current variable-speed motors, controllers, storage batteries, lifting magnets, etc.

(5) That 115 volts is preferable to 230 volts for tungsten lamps.

(6) That 115 volts is far cheaper than 230 volts for truck and tractor battery charging.

(7) That 115 volts is the actual and rightful standard for storage batteries for power, light or control service, and that no modern alternating-current or direct-current switchboard is complete without such a battery (of 80 amp.-hr. or larger capacity) for operating trip coils, relays, remote-controlled circuit breakers, pilot lights and emergency lights. Such a battery is also generally useful around an industrial plant for operating time clocks, solenoid valves and whistles, annunciator systems, fire alarms, autocall systems, telephone equipment, etc.

For these reasons 115 volts was chosen for the direct-current service.

DIRECT-CURRENT SWITCHBOARD IS SUBSTANTIAL

On the new direct-current board circuit breakers were used exclusively, there being no knife switches or fuses whatever. On the back of this board of very substantial construction, the busbar arrangement was both novel and simple.

The breakers were of the Cutter I T E "Directite" type with the positive poles directly above the negative poles, instead of side by side. The bottom studs of each pole were of the horizontal laminated type and were made 9 in. (22.9 cm.) long. Allowing 2 in. (5 cm.) for slate, 2 in. (5 cm.) for the angle framework and 3 in. (7.6 cm.) for intermeshing with the busbars, there was 2 in. (5 cm.) for clearance between the busbars and the framework.

No busbar supports were necessary, the bars being clamped between the laminated breaker studs with busbar clamps. The total-load breaker and all feeder breakers were mounted on the board with the centers of the laminated lower studs exactly in line horizontally, so that the busbars were straight ¼-in. by 3-in. (6.3-mm. by 7.6-cm.) bars running the full length of the board. The upper studs of both poles were laminated vertically, and all ammeter shunts were milled to fit these laminations. Connections between the shunts and outgoing lines were made with the Electrical Engineers' Equipment Company's tongued cable terminals, provided with busbar-type clamps. In order to avoid the unsymmetrical appearance of various-sized cables from No. 0 to 1,000,000 circ. mil, running up from the top of the board to the ceiling, lengths of 4-in. (10-cm.) conduit, mounted with their axes vertical and spaced 12 in. (30 cm.) apart horizontally, were run from the top of the board to the bottom member of the roof truss, being fastened at each end with U-bolts. The lower ends of the conduit were hidden by the top of the board, as they came down below the top-tie channel at the back of the board. Ordinary malleable bushings were screwed on the lower ends. The upper ends were practically hidden by the roof truss and were finished with bushings for open wiring, with LB condulets for conduit work, or were extended on through the roof and capped with FE condulets for lines running over the roofs or on poles to other buildings.

GENERATOR CABLES IN 8-IN. CONDUIT

The generator cables were brought to the board through steel conduit under the floor. This installation is of interest because of the size of the conduit. Ten 1,000,000-circ.mil lead-covered, rubber-insulated stranded cables were run through 40 ft. (12 m.) of 8-in. (20-cm.) conduit. Because of the limitations of space it was not practicable to use five 4-in. (10-cm.) conduits, and the 8-in. (20-cm.) installation was approved by the Underwriters, although standard electrical fittings were not used. The necessary fittings, however, were obtained from sprinkler equipment. The ends were finished by screwing on standard cast-iron companion flanges and bolting to these flanges circular disks of ⅜-in. (9.4-mm.) Bakelite-Micarta, through which ten holes just large enough to clear the cable were drilled. These end

plates kept rats and mice out of the conduit and held the cables symmetrically for fanning out to their terminal blocks. The ten cables, guided carefully, were pulled in with a 12-ton crane, and there was no serious abrasion of the lead sheaths. One-inch pipe rollers were placed about 2 ft. (61 cm.) apart under ten cables before they entered the conduit, and this materially reduced the power required.

The conduit installation for the 4400-volt service to the synchronous motor was unusual in that lead-covered cable was not used. Four Okonite No. 0 type RD 70 double-braid 7000-volt rubber-covered stranded cables were run through 3-in. (7.6-cm.) steel conduit about 80 ft. (24 m.) from the pole line to the oil fuses. G. & W. disconnecting potheads were used on both ends of the conduit. In addition to the service company's expulsion fuses on the pole lines, Schweitzer & Conrad carbon tetrachloride fuses were placed between the inside pothead and the disconnecting switches. These oil fuses have proved particularly valuable in protecting the equipment from excessive mechanical and electrical strains, because of their low-time element, while the G. E. induction relays controlling the oil circuit breakers have been relied upon for protection from damage by heating.

The disconnecting switches were double-throw, with one set of contacts connected to power and one set connected together and to ground, so that there was no damage from static, lightning, leakage or generated voltage while working on the oil circuit breakers or on the motor, as the motor leads were shorted and grounded.

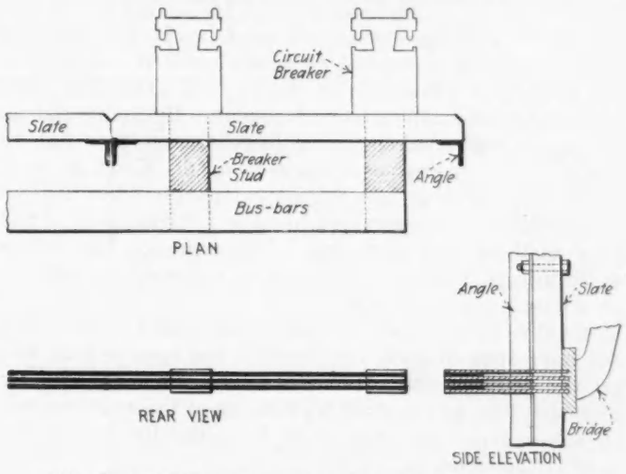


FIG. 2—BUSBARS CLAMPED DIRECTLY TO LAMINATED BREAKER STUDS

switchboard room and in the electrician's workroom. The emergency breaker gave light and power for all repairs, regardless of what trouble occurred. To prevent the battery from carrying any of the light or motor load on the generator buses the charging breaker was tripped out by the tripping out of the oil circuit breakers by manual or relay operation, the tripping out of the total load direct-current breaker by manual or shunt trip operation, reversal of current or overload on the charging breaker or overload on the master breaker. About one time in three the busbar load would be high enough to drag the storage-battery voltage down so low that the shunt trip on the charging breaker could not operate. At other times the interval between the opening of the generator circuit and the clearing of the battery was practically zero. The tripping was made certain by adding a low-voltage trip to the charging breaker, so that its overload setting could be kept high. All load from the battery, except the emergency load, was fed through a breaker called the master breaker, which never opened except on short circuit and which was depended on for the protection of all control and pilot circuits. The field switches of the motor and generator

SIZE OF WIRE, CONDUIT AND SWITCHES FOR 115-VOLT LOADS

B. & S. or American Wire Gage	Rated Motor Horsepower: 1½	2	2½	3½	5½	7½	10½	15	27	50	82	Size of Loom One Wire	Size of Conduit One Wire	Size of Conduit Two Wires	Size of Conduit Three Wires	Size of Conduit Four Wires
	Number of Light Circuits: 1	1	2	3	4	6	7	10	19	34	56					
14	50	...	...	...	...	...	...	...	...	...	...	½	½	½	¾	¾
12	80	60	...	...	...	...	...	...	...	...	...	½	½	½	¾	¾
10	125	95	60	...	...	...	...	...	...	...	...	½	½	¾	1	1
8	200	150	100	70	...	...	...	...	...	...	...	½	½	1	1	1¼
6	320	240	160	120	80	...	...	...	...	...	...	¾	¾	1¼	1½	1½
4	500	375	250	180	125	90	...	...	...	...	...	¾	¾	1½	1½	1½
2	800	600	400	300	200	150	110	...	...	...	...	¾	1	1½	2	2½
0	1,300	960	640	480	320	240	160	125	...	...	...	1	1	2	2	2½
0,000	2,600	1,900	1,300	960	640	480	320	250	150	...	...	1¼	1¼	2½	3	3
500,000	6,000	4,500	3,000	2,200	1,500	1,100	750	600	350	200	...	1½	2	3½	4	4
1,000,000	12,000	9,000	6,000	4,400	3,000	2,200	1,500	1,200	700	400	250	2	2½	4	4½	4½
Knife-Switch Rating	30	30	30	60	60	100	100	200	400	400	600					
Cartridge-Fuse Rating	15	20	25	35	50	70	90	125	225	400	...					
Circuit-Breaker Rating	20	20	30	45	60	80	100	150	300	500	700					
Highest Breaker Setting	19	26	32	45	65	90	115	160	290	520	840					

DIRECTIONS FOR 115-VOLT DIRECT-CURRENT WIRING TABLE

The figures in the body of the table show distances in feet from end to end of two-wire lines. These distances are figured for a 3-volt drop. For intermediate loads or distances use the next larger figures given. Lighting circuits are figured with 12 amp. or 1320 watts each.

STORAGE BATTERY FOR CONTROL AND PILOT SERVICE

One of the most valuable features of the electrical installation was a 115-volt, 80-amp.-hr. storage battery, which was allowed to float on the generator most of the time. This battery operated the oil-circuit-breaker trips, solenoid-operated field rheostats, whistles, time-clock system, autocall, fire alarm, solenoid-operated circuit breakers, annunciator system and emergency lights. Failure of voltage on the lighting feeder for the switchboard and generator room caused a solenoid-operated emergency breaker to trip in and furnish battery energy to several 200-watt lamp and plug sockets in the

fields of the motor-generator set were double-throw and were thus connected to the generator armature or the master breaker. This assured correct polarity in starting up after generator trouble.

CLEARING GROUNDS BY DEAD SHORT

Ground detectors were not used, as it was believed that a constant potential to ground placed a strain on all insulation, reversing in the case of armature coils, and made breakdowns more frequent. By manipulation of the voltmeter plugs the voltage from either line to ground could be read as often as desired. Grounds were cleared by burning them off, a special interlocked double-pole breaker being provided for this. Either side of the line could be dead-grounded. The explosion-like action attending the sudden institution of a power arc instantly cleared many grounds that ordinarily would have gradually carbonized the insulation until they could not have been cleared. As most of the open wiring was on the ceilings and often had to be worked "hot" by men standing on the steel framework of the roof trusses, it was a great convenience to have the lines normally clear of grounds.

STANDARDIZATION OF WIRE AND CONDUIT

One of the greatest savings in reducing maintenance stock and in promoting convenience for the electrical department was made by standardizing the sizes and types of wire and conduit to be used. Formerly Nos. 16, 14, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0, 00, 000, 0000, 500,000-circ. mil. and 1,000,000-circ.mil. wire was kept in stock in weatherproof, slow-burning, single-braid, rubber-covered and double-braid rubber-covered insulations, and some sizes in solid, stranded and rope-laid. Nos. 12, 10 and 8 solid and Nos. 6, 4, 2, 0, 0000, 500,000-circ. mil. and 1,000,000-circ. mil. stranded were standardized in double-braid, rubber-covered, and other sizes and types were discontinued. This materially reduced the stock of wire and of Dossert connectors. Reinforced type P lamp cord was substituted for the common cord telephone bridle wire for annunciator, office and fixture wire, and rope-laid cable was bought only on special order. Duplex was discontinued.

A special wiring table was made up, with motor ratings and light circuits plotted against wire sizes, so that distances in feet appeared in the body of the table. This table was figured for a 3-volt drop with a 118-volt supply. Opposite the wire sizes was shown the size of loom to use for one wire and the size of conduit to use for one, two, three or four wires. Below the motor or lamp load was shown the size of cut-out, switch and circuit breaker to use and the maximum fuse rating or breaker setting allowed. The table of conduit sizes was very carefully worked out and gave considerable leeway on short runs, but the saving in time paid for the extra cost of large conduit. Condulets were next standardized, and out of approximately 5500 kinds listed in the catalogs about 300 were found necessary for the work. One hundred and eighty of these were then kept in stock.

SOLDERLESS CONNECTORS ARE ECONOMICAL

For all taps and splices on cable larger than No. 8, Dossert connectors were used. In fact, tapping and splicing stranded wire has almost become a lost art in the maintenance department of this company. At first Dosserts were only used for temporary test wark, emergency rush work, connections in RS condulet junction boxes and other crowded quarters, and for switchboard work where artistic appearance was essential. In a few months, however, the Dosserts proved so essential in saving time and copper that they were standardized for all splices and taps, and for all lugs with the exception of soldered stamped terminal lugs and tongued clamp terminals for busbar work. After adopting Dossert fittings the electrical department was able to help out in cases of shut-down by making temporary installations that previously would have taken so long as to have been impracticable. A device whereby a helper is enabled to make a perfect splice in "million cable" in five minutes is certainly an improvement over old methods. In fact, in one case where a large number of feeders had to be changed over in thirty minutes men were borrowed from the labor and the millwright departments to help the electricians, and they make good connections with very little supervision.

In a later issue of the ELECTRICAL WORLD other improvements in this plant will be discussed.

ILLUMINATION STANDARDS USED IN SOUTH AFRICA

Representative Figures Showing Good Practice in Illumination Indicate that South African Standards Are Equal to Those in America

For purposes of comparison with American practice, as indicated by the lighting code of the Illuminating Engineering Society, a table of standard illumination values in South Africa follows. These values were given by H. A. Tinson, in a paper entitled "Illumination and Some of Its Fundamental Considerations," recently read before the South African Institute of Electrical Engineers:

	Foot-Candles
Auditorium, church	1.5–3
Public hall, drill hall	2–4
School, classroom or library	3–6
Shops, show window	10–50
Large shops, ground floors on first-class streets	7–10
Clothing, haberdashery, millinery, jewelry	4–7
Drugs, grocery, meat, bakery, stationery, florist, furniture, etc	3–5
Office, private and general	4–8
Drawing office	8–12
Industrial, for rough manufacturing occupations, *i. e.*, rough assembling, rough forging, rough woodworking, ice making, potteries, tanneries, etc	2–4
For medium manufacturing occupations, *i. e.*, rough machinery, rough bench work or automatic machine work, meat packing, paper making, laundries, bakeries, etc	3–5
For fine manufacturing operations, such as fine assembling, leather working, fine woodworking, fine lathe work, tobacco manufacturing, fine sheet-metal working, light-colored textiles, etc	4–8
For extra fine work, *i. e.*, watch and jewelry making, engraving, typesetting, shoemkaing, enameling, manufacturing dark-colored textiles, etc	7 up
Building exterior (surface) lighting	3–15
Street lighting, yards and open areas	0.02–2

MUNICIPAL ownership with all its shortcomings will come unless public utility corporations are permitted to charge for their wares enough to return their operating expenses and taxes and so much for profit as will insure their ability to attract new capital to the enterprise as needed for improvement and extensions of service.—*Walton Clark.*

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

THREE-PHASE UNBALANCED LOADS SHOULD BE LIMITED

Unequal Line Current in Three-Phase Generators Has Demagnetizing Effect on Field and May Result in Burnt-Out Field Windings

Whenever the currents in the three phases of a generator are not equal the armature reaction or demagnetization of the field pulsates with a frequency equal to twice the frequency of the machine. This pulsation of flux induces an alternating current in the field iron and heats the magnetic structure. The extent of this heating depends on the amount of unbalance between the phases. If the out-of-balance current becomes too great, the heat may be sufficient to damage the insulation of the field winding. The General Electric Company has made the following recommendations on this subject for the benefit of operators using different types of machines:

Waterwheel generators should not be operated with a difference in current between maximum and minimum phase of more than 66 per cent of the rated full-load current. This figure should not exceed 30 per cent for turbo-generators with forged field pieces, and the difference should not exceed 15 per cent for turbo-generators with laminated poles. The maximum out-of-balance current for turbo-generators having solid rotors should not exceed 15 per cent if the end rings which hold the rotor windings in position are not insulated. However, it is the general practice to insulate these end rings in most of the modern turbo-generators. The Electric Bond & Share Company printed this advice in one of its engineering letters.

OUTPUT PER KILOWATT-HOUR GIVEN FOR ENAMELING OVENS

Tests on Different Types Indicate that Continuous Conveyor Type Is from Two and a Half to Four Times as Efficient as Others

The increasing use of electrically heated enameling ovens, etc., has resulted in a demand for ovens of better construction and with better insulation than was in general use with the cheaper gas fuel. Some of the ovens which have been developed for electric operation have been tested by the Westinghouse Electric & Manufacturing Company with the following results:

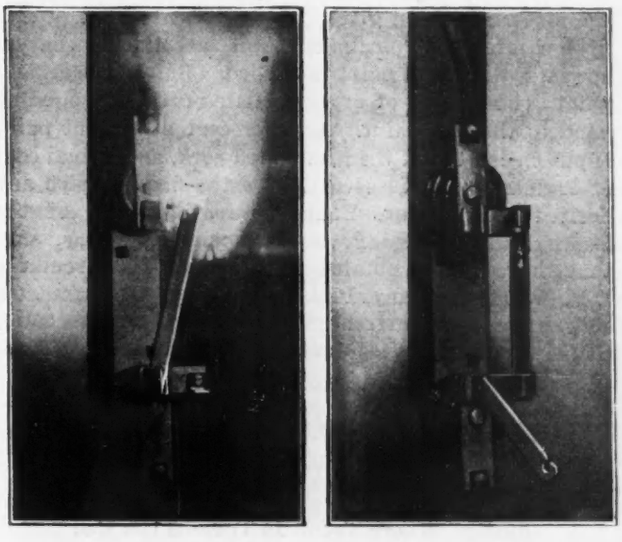
Type of Oven	Method of Handling Material	Output in Lb. of Work per Kw.-hr.
Kiln type	By hand	6 to 8
Kiln type	By truck	10 to 12
Conveyor type	By semi-continuous conveyor	10 to 12
Conveyor type	By continuous conveyor	25 to 30

In all types the oven insulation is placed between an inner and outer metal lining; through metal connections from the interior to the exterior of the oven should be reduced to a minimum. Tests indicate that 1 sq.in. (6.45 sq.cm.) of metal extending from the interior to the exterior surface of the oven will conduct as much heat to the atmosphere as about 7 sq.ft. (6503 sq.cm.) of the high-grade insulation. It has also been found desirable to insulate the floor of the ovens in view of the desirability of obtaining uniform temperature throughout.

PROTECTING DISCONNECTING SWITCHES WITH FUSES

Tests Under Various Loads and Conditions Show that Danger of Operating "Disconnects" Can Be Practically Eliminated

An investigation was recently made by the testing department of a certain central station to determine whether a disconnecting switch could be made safe when pulled under load by shunting it with a fuse of proper design and carrying capacity. Eighteen trials



OPENING A DISCONNECTING SWITCH WITHOUT (LEFT) AND WITH (RIGHT) SHUNT FUSE
Note small arc in fuse near top of inclosing tube

were made under various conditions of load to test the effectiveness of this method of protection. The tests proved successful except in one case where the "disconnect" was pulled deliberately at a very low speed to give the fuse a chance to blow before the switch blade and clips became separated by any appreciable distance. This gave the arc a chance to establish itself across the switch after the fuse had blown. Tests were made with "disconects" both with and without the safety fuse to show the difference in performance of the switch under these two conditions at various loads and voltages. Some of the tests without the fuse were made at 60 amp. at 9000

volts. The arc which formed between the blades under these conditions could not be interrupted by opening the switch to the full distance. The switch was, therefore, closed to stop the arc. The left-hand illustration shows the arc formed between the blade and clips without a shunt fuse. The other picture, taken when a fuse is used, shows the small arc which then occurred in the fuse near the top of the inclosing tube.

It was concluded from the tests that by the use of a fuse of proper design and rating it is possible to shunt a disconnecting switch so that the switch can be pulled under load without any arc forming at the contact. It was found, however, that even with the disconnecting switch properly fused it should be pulled quickly, because if it is deliberately pulled at a very low speed, there is an opportunity for the arc to jump across a small gap after the fuse has blown. In such a case the conditions similar to those on a non-fused switch would be repeated.

CONDENSATION PREVENTED BY TREATING WATER PIPE

Layers of Ordinary Paint, Cork Cement Paint and Granulated Cork Used to Stop Condensation on Cold-Water Pipes

The Pennsylvania Water Company has practically eliminated condensation on cold-water pipes by the use of paint and a layer of ground or pulverized cork. Only on very damp days is there a slight condensation since the pipes have been given this treatment. The pipe is first painted with ordinary paint and then a coat of special cork cement paint is applied. Before the cement paint dries a layer of dry granulated cork is applied by hand to the wet paint. Another coat of cement paint is put on the top of the granulated cork, and a final coat of ordinary paint is used to give the finished pipe any desired color. Alex. Bauhan, superintendent of the Pennsylvania Water Power Company's stations, says that the company obtains the cement paint from the I. P. Morris Company, Philadelphia, and the granulated cork from the Armstrong Pipe Company at Lancaster, Pa., or from the United Cork Company, Lyndhurst, N. J.

SYNCHRONOUS MOTORS IN THE WORKING OF BRASS

Power Requirements of Rolling Mills in the Brass Industry, Where Trend Is Toward the Use of Synchronous Motors

In the issue of April 28 appeared under this heading a table giving data on synchronous motors in brass rolling mills. The heading of one column was erroneously given "R.p.m. of Rolls" instead of "Surface Speed of Rolls in Ft. per Min." The corrected table is herewith reproduced in full:

Operation	Roll Size	Surface Speed of Rolls, Ft. per Min.	Hp. per Stand
Breaking down cast bars..	20 in. to 24 in. by 36 in. (50.8 cm. to 60.9 cm. by 91.4 cm.)	75 to 100	300 to 750
Running down	18 in. to 20 in. by 36 in. (45.7 cm. to 50.8 cm. by 91.4 cm.)	125 to 250	200 to 400
Finishing	10 in. to 20 in. by 36 in. (25.4 cm. to 50.8 cm. by 91.4 cm.)	150 to 250	75 to 200

These data were brought out by W. R. Clark of the Bridgeport (Conn.) Brass Company in a recent paper which he read before the Association of Iron and Steel Electrical Engineers.

IMPROVEMENT EFFECTED IN OFFICE ILLUMINATION

Change to Indirect Lighting and Retinting Ceiling Reduces Energy Consumption and Gives More Satisfactory Illumination

BY JOHN A. HOEVELER

Serious complaints regarding the lighting of the building were made by employees of the general office of the Industrial Commission in the State Capitol at Wisconsin. Investigation showed that the lighting equipment consisted of two domes made up of six panels of opal glass, suspended in the inverted position so as to make semi-indirect fixtures, and eight three-light wall brackets. The illumination from this equipment was inadequate in intensity even at the most favorably placed desk. There was objectionable glare from the bright wall brackets, and deep, sharply defined and unavoidable shadows caused much eye strain.

An installation of luminous-bowl indirect fixtures was substituted for the semi-indirect domes, and the brackets were disconnected. This eliminated glare and objectionable shadows and gave adequate intensity on all desks. However, the light buff ceiling absorbed so much light that the consumption of energy was unnecessarily high. The center panel of the ceiling was then painted a flat white, with the result that the energy consumption was reduced 25 per cent with practically no reduction in the illumination at the desks.

The table gives the results of the illumination test with the old and the new system. It will be noted that with the new system and the light buff ceiling 240 watts less energy was used. At the same time the illumination at the work was increased from 3.8 foot-candles to 12.5 foot-candles for the best lighted desk and from 1.1 foot-candles to 6 foot-candles for the most poorly lighted desk. Painting the ceiling white permitted another reduction in connected load of 500 watts with an intensity of 11.6 foot-candles at the best lighted desk and 5.2 foot-candles at the most poorly lighted desk.

ADVANTAGE OF INDIRECT LIGHTING AND WHITE CEILING

Type of Installation	Ceiling	Walls	Watts	Illumination on Desks in Foot-Candles Max.	Min.	Ave.
Two semi-indirect units (old dome fixtures inverted) and eight wall brackets	Light buff	Light buff	2240	3.8	1.1	*
Two luminous-bowl indirect units equipped with mirrored reflectors; no wall brackets	Light buff	Light buff	2000	12.5	6	9.1†
Two luminous-bowl indirect units equipped with mirrored reflectors; no wall brackets	Center panel painted white	Light buff	1500	11.6	5.2	8.9†

* Not enough tests made to give a true average value.
† These values are not the average of maximum and minimum readings, but the average of a sufficient number of tests at enough stations to give a true average value for the room.

A satisfactory intensity of illumination at the work for offices is 6 foot-candles. Hence it will be seen that all desks now get adequate light and yet the connected load required to give service is 740 watts less than was installed with the old unsatisfactory system.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

MAKING PROPER RATES FOR ELECTRIC WELDING

Present Practice in Some Cases Seems to Result in Equitable Charges, but in Other Instances Changes in Methods Are Necessary

BY C. I. CRIPPEN*

It seems proper at the present time to look into the central-station revenues from electric welding. Direct-current arc welding where the welding current is supplied through the usual motor-generator sets does not offer the disadvantages of the other classes of welding, although the load factor and power factor are lower than central stations would like. The load, however, is sustained for an appreciable length of time, all conditions being quite stable during the load interval, or in other words until the arc breaks. Alternating-current arc welding in its common application will probably have about the same general characteristics as the direct-current process except that the power factor and the load factor will be slightly lower. As more data are available this load can be more closely analyzed. In brief, it would seem that present practices as to demand and energy measurements carefully applied and translated into dollars through existing rate schedules which take account of power factor conditions will yield a very reasonable return on investment and energy costs. Study should be given this situation as experience grows, particularly with reference to alternating-current arc welding.

Resistance-Welding Rates Need Special Examination

Resistance welding, including both spot and butt welding, appears to require special attention to determine whether or not the return calculated in the ordinary fashion is commensurate with the service rendered and does not discriminate in favor of the small spot-welding installation

The normal rating of the usual spot-welding equipment ranges from 5 kw. to 75 kw. per welder, with ratings of about 30 kw. predominating. The usual operation of such a welder calls for the very frequent instantaneous closing and opening of the circuit, and from a large number of observations it has been noted that the load interval ranges close to a half second for a typical welding operation. Occasionally a welder is observed on work requiring a load time of as high as three seconds, but such cases are exceptional and nearly every installation is included in the former class. The cycle of welding operation varies greatly according to the work being handled and ranges from as low as thirty to as high as 1000 welds per hour, while the average installation probably makes 400 welds per hour, or about seven per minute throughout the working day, this being based on the assumption that there is sufficient work at hand to keep the welder busy.

Metering equipment is called upon to measure, therefore, a load of 30 kva. to 40 kva. for half a second or less possibly seven or eight times per minute for the average installation. Theoretically present-day meters should measure such a load in a satisfactory manner, but from experience it would seem that this does not actually work out in practice. A casual observation of the theoretical performance of the integrating watt-hour meter reveals the fact that its ability to measure such a load is based on the assumption that even though the meter disk lags behind the load to a certain extent during the acceleration period, yet this lag in acceleration is counterbalanced by the same lag in deceleration, with the result that the meter should record the actual load over the given time. It seems to work out, however, that the load interval is so short and the peak so abrupt that it virtually amounts to a short-circuited condition for the period of load on the welder. Perhaps metermen will question this statement, yet from close observation covering several years and by independent observations it is reasonably safe to say that the energy registered on a small installation of such welders probably does not amount to more than 25 per cent to 35 per cent of the current used.

Load Curve of a Group of Welders

For a group of welders it would seem that the load curve should straighten out materially and that the energy consumption as registered should correspond very closely to the actual use. In one specific instance in which observations have been made, consisting of ten welders with the welders in regular operation, tests taken on a single-phase meter on the welder circuit indicated an average requirement of but 12.5 kw. during a ten-minute test, compared with a total rating of 250 kw. for the welders. These welders were making fifteen welds per minute on each machine, and even though the operation of the welders would have been such that the load was constant and calculating only one-half second per weld, the meter should have indicated an average requirement of not less than 45 kw., or almost four times that actually shown. As a check against the above data a test is cited where a group of welders rated at 400 kw. were operated from a single-phase generator of 150 kva. rating, and with these welders in regular operation the generator lacked sufficient capacity to hold up the voltage, making it necessary to reduce the number of welders. From general observation it would seem that the rating of a generator or transformer and line to supply spot welders should be approximately one-half of the capacity to be supplied.

From this it appears that in the small installation the energy as registered is probably less than that actually used, while usual methods of demand measurement also fall short. It would, therefore, seem logical that some

*From a paper read before the commercial men of the Ohio Electric Light Association

special means should be provided to determine that the company's revenue does correspond with the service rendered. It has also been brought out that the single-phase generator capacity required for a group of welders must be equal to at least one-half of the total welder capacity, and in case a consumer were putting in a generating equipment of his own to supply this service for a group of say five to ten welders, it would be necessary for him to provide generator capacity in which the kilovolt-ampere rating would be approximately one-half of the welder rating in kilowatts.

The Problem of Metering

The problem presented in providing a proper and sufficient metering arrangement is one requiring detailed study and is beyond the scope of this article, so that a means should be provided for producing the required revenue by the use of the metering equipment now at hand. In an installation where the welding load forms a considerable proportion of the total, or where we have an installation of welders only, the above observations hold true; but where the proportion of welder load to the total load becomes small it is readily seen that the power required for welders, the peaks and low power factor is absorbed in the total, so that the deficiencies in measurement do not apply in so acute a fashion with this combination as in the former. One other point is perhaps necessary in order to make the situation clear, since it has been suggested by some central-station operators that the transformer capacity is the proper measure of the maximum demand. It is only necessary to reflect for a moment in order to understand that the modern transformer has a very considerable overload capacity, and if the overload is not sustained for a sufficient length of time to develop excessive heat, the transformer will handle high peaks without injury. Applying this to spot-welding practice, it is possible to make use of the overload capacity by having a group of service transformers handle peaks ranging to 200 per cent or 250 per cent of their rating. It is in the distribution lines, however, that the effect of the welders is measured, for the short acute peaks pull down the voltage, and if these same distribution lines are used for lighting purposes the regulation is extremely poor unless the lines are of ample size to accommodate the total load, including the high peaks of the welders. Therefore the measure of capacity allotted to the welding load is the line proper rather than the measured demand or the transformer capacity.

As was suggested, the single-phase generator capacity required to serve a group of welders would probably equal one-half of the total welder rating. On this assumption it would be proper to bill the maximum demand at one-half of the connected welder load. This, however, might seem a little severe on the consumer, and, bearing in mind that he has welders out of service very frequently, it is suggested that in the case of a single welder the maximum demand be taken at the full rated capacity of the welder, that in the case of perhaps two or three welders the demand be taken at 60 per cent of the total rated welder capacity, and that in installations running from four to seven welders a factor of 50 per cent be employed and that for larger installations the factor be 33⅓ per cent. These values are rather favorable to the consumer, since it is well established that his own capacity to save time if furnished from a private plant would be considerably higher. For the installations where the welder load is but a small part of the total load it would seem advisable to have demand tests taken frequently if demand meters are not used, since the welder load may have an appreciable bearing on the total demand. In these installations, however, it is probable that the effect will not be greatly noticeable, and furthermore in many of such installations the consumer provides his own transformer equipment and is responsible for the regulation of lighting service used from his main transformers so that the problem is about equally divided between company and consumers.

CHECKS MADE IN FAC SIMILE CAUSE MISUNDERSTANDING

Utility Customer Stockholders Confuse Them with Regular Dividend Payments, and Some Manage to Cash Them at Local Banks

As a part of its publicity campaign in connection with utility stock sales to its customers, a central station recently sent out fac-simile checks to prospective stock buyers. These checks were clearly intended for advertising purposes only, and while they were properly filled out and indorsed each was carefully rubber-stamped "Copy" and advertising matter was printed on the back of the check and on the lower part of the sheet to which it was attached. The printed text was

> Could you use a check like this every three months?
>
> Our shareholders get them and will continue to get them as long as they hold their stock.
>
> You become a shareholder and you too can depend on it that the mailman will bring your check on March 1st, June 1st, September 1st and December 1st each year as regularly as the months roll round.
>
> (Your money is safely and profitably invested when it buys Preferred Stock.)

NOTWITHSTANDING THIS EXPLANATION, SOME THOUGHT THE CHECKS REAL

especially clear in its meaning. It invited the recipient of the fac-simile check to become a shareholder of the company, pointing out that by so doing he could be sure of the receipt four times a year of a real check similar to the one represented. That any mistake could be made concerning the nature of this advertising circular never probably entered the heads of the company's officials when they thought of the plan.

However, in spite of all these precautions, some of the people who got the checks thought that they were receiving dividends on stock already purchased. They therefore detached the white printed section of the sheet from the green check and presented the fac-simile checks at their banks. Not all of the local banks were familiar with the central-station company's activities, and the result was that some of the fac-simile checks were actually cashed, causing no little confusion of a mingled amusing and serious character. In the end the whole affair was satisfactorily settled, but the company has decided not to use any more "near checks" as publicity matter, thereby inviting an unexpected draft on its bank funds.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Core Defects in Electric Apparatus.—M. VIDMAR.—Insufficient attention is often paid to the construction of the magnetic cores of electrical apparatus. Eddy-current losses are often increased by electric contact being formed between the edges of the laminations of which the core is built up. These losses can be greatly decreased by care in the design and construction. The paper that is often placed between the laminations is an impediment to the flow of heat in a direction from lamination to lamination through the core, and it is often desirable to dispense with this paper insulation. Bolts and rivets through the core should be avoided where possible. In some cases they remove the most effective portion of the magnetic circuits and in others they complete electric short circuits in which heavy currents flow. Such bolts and rivets should be well insulated from the core. The transfer of heat through the magnetic pocket is considered. Small potential differences between the ends of a prismatic element of iron may cause very great heating. For instance, a potential difference of 0.2 volt may suffice to raise the temperature of the iron 1000 deg. C. The presence of a small iron filing between the laminations may cause excessive current densities to be produced.—*Technical Supplement Review of Foreign Press*, April, 1919. (Abstracted from *Electrot. u. Maschinen.*, Jan. 5, 1919.)

Standardization of Transformers in Germany.—The German standardizing committee has issued rules to cover the construction of transformers with aluminum windings. These are classified in two groups—the first for normal transformers and the second for special transformers for agricultural purposes. For each group the capacities, voltages, percentage short-circuit voltages, temperature rise, overload capacity and various details of construction are laid down. An explanatory memorandum on the standardizing rules is given by Dr. Stern.—*Technical Supplement Review of Foreign Press*, April 1, 1919. (Abstract.)

The Half-Synchronous Working of the Induction Motor with Single-Phase Rotor.—G. VALLAURI.—It was recently observed that a synchronous polyphase motor when started as an asynchronous one by short-circuiting the direct-current circuit sometimes approximately reaches the half-synchronous speed but cannot surpass it. In this condition the motor develops altogether a positive torque. The author remarks that the same phenomenon was already observed by Gorges about twenty years ago in starting a polyphase induction motor the rotor of which had been rendered single-phase by lifting one of the brushes from its slip ring. The theory of the phenomenon was also given by Arnold in his "Induction Motors." But as this phenomenon is not well known, the author has made a series of experiments to throw more light upon it. The rotor current generates an alternating magnetic field which can be considered as the resultant of two fields rotating at different speeds, the one synchronous with the field generated by the current of the main, rotating at $n_1 = f/p$ rev. per sec., the other rotating, always with respect to the stator, at $2n - n_1$ rev. per sec., where n represents the revolutions per second of the rotor. This latter field induces in the stator windings an emf. of frequency $f' = (2n - n_1)p$, which in its turn generates a current of which the intensity and the phase will depend on the impedance of the external circuit and, in particular, on the number, power, etc., of the apparatus inserted in the circuit. As a first approximation the motor running at about half-synchronous speed can therefore be considered as formed by two motors in cascade, in the first of which the stator is the inductor, while in the second one the inductor is constituted by the motor. The approximately half-synchronous speed disturbs the phase line, as the load is not equally distributed over the three phases, but is in turn more or less derived from each phase. In particular, if the speed is rigorously half-synchronous, the three phases are differently loaded, but no cyclic phase interchange of the load takes place. Hysteresis phenomena give to a motor a certain stability at half-synchronous speed. In conclusion, the working of a three-phase motor with a single-phase rotor at half-synchronous speed can be made use of without very serious inconvenience. A large number of curves and diagrams illustrate the article.—*Science Abstracts, Section B*, March, 1919. (Abstracted from *Elettrotecnica*, Jan. 15, 1919.)

Generation, Transmission and Distribution

Switchboards, Their Design, Installation and Maintenance.—J. H. SANDIFORD.—The functions of a switchboard are discussed and the design of switchboards is considered. —*Electricity*, April 4, 1919.

Lubricants for the Power Plant.—REGINALD TRAUTSCHOLD.—Essential properties of a lubricant, the specific gravity, acidity tests, evaporation test, test for animal oils, quality test, suitable oil lubricants, engine oils, cylinder oils and various other kinds of oils are discussed in this article.—*Power Plant Engineering*, April 15, 1919.

Hydroelectric Development at Vernes.—Description of this development, together with cross-sections and views of the hydraulic turbine-driven generating units, are given. Plant data are also listed.—*Power*, April 15, 1919.

Use of Oblique Axes in the Solution of Transmission Line Problems.—V. KARAPETOFF.—It is shown that the oblique axes may be so chosen that the equations of projections of vector triangles are much simplified. The voltage regulation of the line is then computed, taking into account the line capacity concentrated at the two ends of the line. Explicit instructions are appended at the end for the procedure in a given case. The number of articles which appear year after year on transmission-line computations are an indication that there

is ample room for improvement and simplification of the methods in use. This paper deals with a common case when the generator voltage and the load kva. are given and the power factor of the load is also known. It is required to compute the voltage regulation of the line, assuming the line capacity to be concentrated at the ends. The difficulty lies in the fact that the load current is not known, so that the line impedance drops cannot be computed directly.—*Sibley Journal of Engineering*, April, 1919.

Interconnection in Switzerland.—Abstract of an article by E. Kohler in *Technik und Industrie* regarding the proposed high-tension line from Geneva to Lake Constance tying in the more important electrical power houses of Switzerland. The extensive water-power projects established and under way in that country make it important to insure the best utilization of the energy produced by the central stations. A syndicate has been formed with this object in view, and a plan has been adopted to construct a line 133 km. in length, with aluminum conductors, six cables, to operate at 30,000 kva. The price is estimated at 8,500,000 francs, and it is hoped to finish the work of construction in two years. Not only will energy be equitably apportioned between the central stations, but it will be sold in bulk. Railroad electrification is another important object of the projected interconnection.—*Revue Générale de l'Electricité*, April 12, 1919.

Three-Phase to Two-Phase Transformation with Single-Phase Transformers.—E. G. REED.—Calculations are made showing the current and voltage relations for two-phase-three-phase transformation, and diagrams are developed from which regulation data are obtained.—*Electric Journal*, March, 1919.

Traction

Electric Traction and Hydraulic Power in Italy.—This article, by an anonymous author, is the continuation of two others upon the subject, the rolling stock of electric railways. The principles upon which the comparison of the different systems must be founded are developed at length and demonstrated by the aid of practical data. The comparison includes steam, three-phase, single-phase and direct-current high-tension systems. Comparative tables of data and of results of operation are given. The conclusions of the author are favorable to the high-tension direct-current system.—*Science Abstracts, Section B*, March, 1919. (Abstracted from *Elettrotecnica*, Feb. 5, 1919.)

Installations, Systems and Appliances

Alternating-Current Plunger-Type Relays.—VICTOR H. TODD.—Photographs of instruments and curves showing the time characteristics, diagrams of relay and transformer connections and of resetting devices are shown in this article.—*Power*, April 29, 1919.

Electric Welding: Its Theory, Practice, Application and Economics.—H. S. MARQUARD.—The various properties of metals which have an important bearing on difficulties experienced in welding are dealt with. These include melting points, specific heat, oxidation, expansion and contraction. A brief classification is then given of the electric welding processes now in use.—London *Electrician*, March 28, 1919.

Combustion and Flue Gas Analysis.—JOSEPH W. HAYS.—The author tells why some excess of air is necessary and why an unnecessary excess of air is very wasteful. He discusses how flue-gas analysis detects excess air and why the use of a pyrometer saves the fuel. A list of instruments that can be used is given along with the best requirements for their use and installation.—*Technical Paper No. 219*, Bureau of Mines.

Electric Welding and Welding Appliances.—The first of a series dealing with the development of electric welding. The article is devoted mainly to the historical aspect of the subject and to a discussion of fundamental processes of electric welding.—London *Engineer*, Feb. 14, 1919.

Main-Control Equipment of the New Mexico.—C. T. HENTSCHEL.—One of the outstanding features of the battleship New Mexico is the unique control of its propulsion machinery. The keynote of the control system is flexibility. This property, coupled with the ability of either or both generating units to drive all four propeller motors, produces a propulsion equipment of great reliability. In this article may be found in detail the construction and interrelationship of the units of the control apparatus.—*General Electric Review*, April, 1919.

Improved Contact Design and Material.—H. VON FLEISCHBEIN.—Causes of trouble in delicate contacts are discussed and means are suggested for their elimination. Further developments in tungsten contacts represent a considerable improvement and make tungsten a complete substitute for platinum in this service. There are innumerable applications in which it is of great importance that weak-current contacts should give good and reliable service. The advantages of platinum as a contact material are freedom from oxidation, relative hardness and high melting point. Tungsten is unaffected by steam and acids at ordinary temperatures and can be worked only at glowing heat. Tests were made with contacts interrupting from 0.5 amp. to 10 amp. up to twenty times a second. Owing to the variable current, sparking could not be eliminated completely by parallel capacity and resistance. At first a pencil of tungsten 3 mm. in diameter was used as stationary contact, working against platinum contact on a steel spring. After six months the tungsten showed no sign of wear, but the steel showed colors indicative of severe heating. More successful results were obtained by increasing the cooling facilities and by making the second contact of tungsten (a disk 3 mm. in diameter by 0.5 mm. thick, welded on to a small iron cylinder). Vigorous arcing, due to three times normal current, resulted in no damage even after prolonged trial. Subsequently tungsten disks were welded successfully to brass, steel and German silver by spot-welding in an inert atmosphere. An ordinary arc-lamp transformer can be modified to provide suitable welding current at 5 volts to 10 volts. Owing to the high resistance of tungsten, the contact pieces should not be longer than necessary. Tungsten can be used satisfactorily for even the smallest and finest contacts, and should not be regarded as merely a "substitute."—*Science Abstracts, Section B*, February, 1919. (Abstracted from *Elektrot. Zeits.*, Nov. 7, 1919.)

Flow of Water Through 1½-in. Pipe and Valves.—FREDERICK W. GREVE, JR.—Loss of head through globe valves and straight pipes and the relation of the diameter of the pipe to the loss of head and discharge are plotted in a curve. A description of methods used and photographs of apparatus are given.—*Bulletin No. 1*, Engineering Equipment Station, Purdue University, July, 1918.

Electric Motor Vehicles.—F. AYTON.—The construction, care and upkeep of electric motor vehicles are discussed, together with diagrams of power circuits and diagrammatic illustrations of the windings of the type of electric motor used on electric vehicles.—*Electric Vehicle*, December, 1918.

Electrophysics and Magnetism

On the Fundamental Law of Electrical Action.—MEGH NAD SAHA.—In this paper an attempt has been made to determine the law of attraction between two moving electrons by the aid of the new electrodynamics as modified by the principle of relativity.—*Philosophical Magazine and Journal of Science*, April, 1919.

Electrochemistry and Batteries

Electroplating on Iron from Copper-Sulphate Solution.—OLIVER P. WATTS.—A discussion on getting good electroplatings of copper upon iron by preliminary dipping of the iron in solutions of various metals which lie electrochemically between iron and copper. Nickel can be deposited upon aluminum by using a ferric-chloride dipping solution.—Paper presented before the thirty-fifth meeting of the American Electrochemical Society, April 3, 1919.

Remarkable Pitting of Electroplating.—OLIVER P. WATTS.—When making some lead platings heavy pitting suddenly and irregularly appeared. After considerable study of the cause it was finally found to be due to the air dissolving in the electrolyte while it was resting over-night and cooling, the air being then expelled as minute air bubbles on the work when the bath was heated by the passage of the current. The microscopic bubbles clinging to the work, which had been left immersed in the bath, started the pitting.—Paper presented before the thirty-fifth meeting of the American Electrochemical Society, New York City, April 3, 1919.

Units, Measurements and Instruments

Centrifugal Tachometers of the Rotating Pendulum Type.—W. WILKES.—The author presents a critical investigation of the characteristics of centrifugal tachometers of the rotating pendulum type. The static properties of the pendulum as well as the scale division are considered. The fundamental requirement is that each position of the pointer shall correspond to a single definite speed. This essential being obtained, the question of range and scale division may be considered. Usually it is desired to obtain an even scale, but sometimes a particularly open scale is desired in the neighborhood of the normal speed. Only an approximately even scale can be obtained, however, with a centrifugal tachometer, and the range is limited so far as concerns a good scale. Moreover, the zero is "suppressed," the readings commencing at a certain speed. The stability of the pendulum determines the single significance of a given deflection. The article investigates the scale pitch and measuring range, together with the static properties of various tachometers. Influences of temperature and friction are not considered. The types of tachometer considered are: (1) With torsion spring (Morell cross-pendulum type); (2) with weight loading (Morell); (3) with tension spring perpendicular to spindle (precision tachograph; (4) with epicyclic drive (Morell); (5) with spring and weight loading. In each case the mechanism and general principle of the tachometer are explained. The characteristics of the several tachometers differ materially one from another. Several of the types fail to comply with the condition of a single definite deflection for each speed beyond a certain range. The limitations of each type are discussed in the original. The Morell tachometer with epicyclic drive, concerning which nothing has hitherto been published, is treated very fully.—*Science Abstracts, Section B*, February, 1919. (Abstracted from *Zeits. Vereines Deutsch. Ing.*, Nov. 16 and 23, 1918.)

Telegraphy, Telephony and Signaling

Radiation from Antennas of Various Shapes.—W. BURSTYN.—The radiation characteristics are calculated for a number of types of antenna for all directions in space, and the ratio of the maximum to the mean radiation is determined. It is shown that an antenna of U-shape radiates with virtual equality in all directions under certain conditions, and that an antenna of spiral shape emits a rotating field.—*Technical Supplement Review of Foreign Press*, April 1, 1919. (Abstracted from *Jahrbuch der Drahtlosen Telegraphie*, January, 1919.)

The Loop as a Wireless Receiver.—W. BURSTYN.—The calculations show that the receiving power of a closed loop is approximately proportional to the third power of its linear dimensions and decreases with increasing wave length at a more rapid rate than in the case of an open receiver.—*Technical Supplement Review of Foreign Press*, April 1, 1919. (Abstracted from *Jahrbuch der Drahtlosen Telegraphie*, January, 1919.)

Post-War German Wireless Activity.—The telegraphy research department has resumed its work in research in wireless telegraphy since the end of the war. At a meeting held in December, 1918, the agenda included the preparation of lists of names of persons who had been occupied on scientific and technical work in wireless telegraphy during the war, the determination of the state of their various investigations, the collection and publication of reports and patents originated during the war, the continuation of the work begun and methods of using available apparatus. The department was requested to take charge of documents and apparatus to prevent the loss of scientific information that had been obtained. The *Jahrbuch der Drahtlosen Telegraphie* was requested to publish a list of secret patents and important foreign patents with short explanatory notices.—*Technical Supplement Review of Foreign Press*, April 1, 1919. (Abstracted from *Jahrbuch der Drahtlosen Telegraphie*, January, 1919.)

Miscellaneous

Eighth Annual Report by the Director of the Bureau of Mines.—The general work of the fuels and mechanical equipment division under O. P. Hood, chief mechanical engineer, is discussed. Investigations completed, special problems of war work, mechanical equipment of mines and the study of Illinois coals are also included. The electrical equipment of mines, of which H. H. Clark was in charge, made tests on permissible apparatus in mines. Electrical furnaces for melting brass were tested and the preparation of alloy steels and electric smelting of manganese ore were discussed. A small handbook on the use of fuel oil was completed during the year and will be soon published in coöperation with the United States Fuel Administration. This was prepared by J. M. Wadsworth, consulting engineer of the Fuel Administration.—Bureau of Mines report, year ended June 30, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

WATER-POWER LEGISLATION ALREADY UP IN CONGRESS

Three Bills Introduced in Senate, and House of Representatives Creates Another Special Water-Power Committee

Water-power legislation in three different forms has been introduced in the Senate at the present extraordinary session of Congress, and the House of Representatives has passed a rule providing for the creation of another special water-power committee similar to that which worked a bill through the House at the last session of Congress, although the proposed legislation failed in the Senate as the old Congress ended, owing to the filibuster on President Wilson's foreign policies.

Representative Gillette, the new Speaker of the House, has been charged with the duty of naming the new special water-power committee. The committee will be made up of members of the committee on interstate and foreign commerce, the committee on public lands and the committee on agriculture, and will consist of the chairmen of those committees and their ranking members.

Representative Campbell of Kansas took a leading part in having the House pass the rule providing for the new committee. The rule is as follows:

"Resolved, that the Speaker of the House be and he is hereby authorized and directed to appoint a special committee of eighteen, to whom all bills and resolutions heretofore or hereafter introduced during the Sixty-sixth Congress pertaining to the development or utilization of water power shall be referred, notwithstanding any general rule of the House to the contrary."

The three forms in which legislation has been proposed in the Senate are as follows: A bill (Senate No. 152) by Senator Jones of Washington to create a Federal Power Commission and to define its duties and powers, to provide for the improvement of navigation, for the development of water power, and for the use of the lands of the United States in relation thereto, which was referred to the committee on commerce; a bill (Senate No. 220) by Senator Walsh of Montana, to amend the act to regulate the construction of dams across navigable waters approved June 21, 1906, also the act approved June 23, 1910, and to provide for the improvement and development of waterways for the uses of interstate and foreign commerce, which was referred to the committee on interstate commerce; a bill (Senate No. 651), by Senator Shields of Tennessee, to provide for the construction of dams across the navigable waterways of the United States, for their improvement and development, and to provide for the lease and use of public lands and the development or utilization of water power in the streams running through or adjacent to them.

Speaker Gillette announced the personnel of the new water-power committee as follows: Representatives Esch of Wisconsin, Hamilton of Michigan, Winslow of Massachusetts, Sinnott of Oregon, Smith of Idaho, Elston of California, Haugen of Iowa, McLaughlin of Michigan, Anderson of Minnesota, Sims of Tennessee, Doremus of Michigan, Barclay of Kentucky, Ferris of Oklahoma, Taylor of Colorado, Baker of California, Lever of South Carolina, Lee of Georgia and Candler of Mississippi.

SUMMER SECTION MEETINGS OF ASSOCIATED MANUFACTURERS

Tentative List of Meetings to Be Held at New London, Conn., from June 16 to 18—Program Includes General Association Meeting

A tentative schedule for the section meetings of the Associated Manufacturers of Electrical Supplies to be held at the Hotel Griswold, Eastern Point, Conn., on June 16 to 18, has been issued by Charles E. Dustin, the general secretary. The hours of the different meetings have not been fixed. With the exception of the meetings arranged for Monday, this will be considered at the general meeting on the evening of June 16 and arrangements made to meet the convenience of the members.

As an interesting program has been arranged for the Monday evening meeting, Mr. Dustin expresses the hope that all members will arrive early on that day. It is also suggested that the secretary of each section send notice to the members of his section, calling attention to the meetings and urging attendance, and also that reservations be made through Mr. Dustin's office. Ladies will be welcomed and special arrangements will be made for them.

The schedule of meetings follows:

Monday, June 16

Outlet-Box Section.
Industrial and Street-Lighting Fixture Section.
Signaling Apparatus Section.
Air-Circuit-Breaker Section.
International Trade Committee.
General association meeting in the evening for all members.

Tuesday, June 17

Heating-Appliance Section.
Electrical Porcelain Section.
Molded or Formed Insulation Section.
Rigid-Conduit Section.
Non-Metallic Conduit Section.
Armored Conductor and Metallic Flexible-Conduit Section.
Lamp Receptacle and Socket Section.
Attachment-Plug Section.
Snap-Switch Section.

Wednesday, June 18

Fuse Section.
Knife-Switch Section.
Panelboard and Switchboard Section.
Line-Material Section.
Wire and Cable Section.

ELECTRIC POWER CLUB IS TO ENLARGE ITS WORK

Membership Divided Into Eleven Working Sections and Provisions Made for Recognizing Departure from Adopted Practice

At the annual meeting of the Electric Power Club on Thursday, Friday and Saturday of last week at Hot Springs, Va., important changes in the form of organization and in the methods of doing work were acted on. The membership will hereafter be divided into working sections and greater initiative and responsibility will devolve on each working section. The sections recommended by the board of governors and adopted by the club are at present as follows: Transformer, industrial control, power switchboard and oil circuit breaker, mining and industrial locomotive, motor and generator (not including turbo-driven apparatus), turbo-driven apparatus, storage battery, electric welding, electric furnace, portable electric tool and electric measuring (not integrating) instrument.

The existing standards of the club were also divided into two classes, namely, adopted standards and recommended practice, and it is contemplated that this departure will finally solve the 50 deg. motor question by specifically authorizing the 50 deg. general-purpose motor and the 50 deg. direct-current generator, as a departure from the adopted standards of the Power Club.

Reports were presented by committees on vertical and back-gear motors, underwriters, power switchboard and oil circuit breakers, large polyphase alternating-current motors, direct-current generators, industrial control, cost accounting, labor and transformers.

The same standard ratings as have been adopted by the club for horizontal motors are recommended for vertical alternating-current and direct-current motors ranging from 2 hp. to 200 hp. The maximum speeds for direct-current and alternating-current 60-cycle back-gear motors are 1100 r.p.m. for the sizes ranging from 2 hp. to 15 hp., 900 r.p.m. for the 20-hp. to 25-hp. sizes, and in the case of 25-cycle motors the maximum speed for motors ranging from 2 hp. to 25 hp. in rating is 750 r.p.m. All of the back-gear motors have standard gear ratios of five to one and conform to the code standards as to voltage and phase.

The Underwriters' committee does not believe it desirable for the Bureau of Standards to issue a combined safety and national electrical fire code at the present time and is opposed to a combined fire and safety code for several reasons. Rules were adopted for 50 deg. rated direct-current generators in addition to the rules now enforced for 40 deg. rated direct-current generators. The committee on cost accounting discussed the direct and indirect results of uniform accounting methods in the electrical manufacturing industry.

ETHICS IN BUSINESS

In his presidential address Clarence L. Collens, 2d, dwelt on the industrial consciousness which the war has served to develop and on the definite responsibility and moral obligations existing between manufacturer and manufacturer and between the manufacturer and the industry. Barbarous price wars, destructive and wasteful competition, patent litigation and secret contracts, as well as all forms of commercial and industrial robberies directed against fellow manufacturers, are being thrown aside, so that progress and advancement may be made along the lines of equity, fair play and full recognition of the rights of others.

Mr. Collens pointed out that membership in the Electric Power Club should be recognized as a sincere desire to advance the best interests of the industry, to promote confidence, business stability and good will, to discourage trade abuses, to refrain from unfair competition and price discrimination, and involves a definite acceptance of moral obligations toward all other manufacturers in the industry and of a definite code of ethics in relation both with competitors and with customers.

While the work of the club has been very largely devoted to setting up technical standards for the commercial products manufactured, it is obligatory on the membership that the products manufactured conform with the standards established. Mr. Collens is personally in favor of an open price policy both to the public and the industry. He also feels that the club should investigate and adjust differences developing between members, especially cases involving patent infringement. He proposed a code of ethics covering competitive business relations.

COÖPERATION IN INDUSTRY

Secretary William C. Redfield of the Department of Commerce addressed the meeting on Saturday, May 25, on coöperative relations between industry and the Department of Commerce and the opportunities offered by the Industrial Coöperative Service Bureau. Mr. Redfield drew examples from other industries to show to what extent the Department of Commerce had assisted manufacturers. He also dwelt on the world situation and the opportunities which were open to electrical manufacturers, particularly in France and Italy. European nations, he said, owe us stupendous amounts of money, and unless the United States assists those countries and their industries to become profitable, their ability to repay the debts in any reasonable time is open to question.

The French Republic and Italy are greatly in need of coal for power in their industries, but immense water-powers in the Alps and Pyrenees could be developed to supply this needed power. He suggested that this is a field awaiting American enterprise and application of American machinery. Secretary Redfield is a firm believer in developing the water powers of the world and characterized their non-development as a social crime of no small magnitude.

Other speakers at the Saturday session were Judge Zollar, who spoke of national and state taxation, and Gilbert H. Montague, who spoke on foreign trade combinations under the Webb bill.

Officers were elected as follows: President, James Burke, Burke Electric Company, Erie, Pa.; vice-president, A. L. Doremus, Crocker-Wheeler Company, Ampere, N. J.; secretary, C. H. Roth, Roth Brothers & Company, Chicago; treasurer, R. J. Russell, Century Electric Company, St. Louis, Mo. Four members of the board of governors were elected as follows: E. R. Harding, Holtzer-Cabot Electric Company, Chicago; James Burke, Burke Electric Company, Erie, Pa.; H. F. Stratton, Electric Controller & Manufacturing Company, Cleveland, and A. L. Doremus, Crocker-Wheeler Company, Ampere, N. J.

LARGE BUSINESS OF THE WESTINGHOUSE COMPANY

Sales Billed in Year Ended March 31, 1919, Aggregate $160,300,000—Unfilled Orders on April 1 Amount to $76,200,000

Sales billed by the Westinghouse Electric & Manufacturing Company and its proprietary companies in the fiscal year ended March 31, 1919, reached the large total of $160,379,943. This represents a great increase over the preceding year, when the total was $95,735,407. Sales billed as stated in the report of the company include shipments by the New England Westinghouse Company and the J. Stevens Arms Company from Jan. 1, 1918, although the aggregate amount of these shipments is not given separately. The fact that there would be a heavy increase in the volume of business during the year just closed was fully forecast by a statement in the annual report for the year ended March 31, 1918.

It was stated there that as of April 1, 1918, the value of unfilled orders on hand was $147,857,580, of which $110,185,007 was for regular products of the company. After the elimination of contracts and orders canceled as a result of the signing of the armistice, the value of unfilled orders on April 1, 1919, was $76,248,000.

Operations of the company for three years compare as follows:

	Year Ended March 31		
	1919	1918	1917
Gross earnings—sales billed	$160,379,943	$95,735,407	$89,539,442
Cost of sales—cost of manufacture, including depreciation of property and plant and all selling, administration and general expenses and all taxes	*144,667,402	80,225,937	72,077,752
Net manufacturing profit	$15,712,541	$15,509,470	$17,461,690
Other income	1,623,262	1,325,263	1,386,547
Gross income from all sources	$17,335,803	$16,834,733	$18,848,237
Less—Inventory adjustments, inactive apparatus and materials stripped, bad accounts and extraordinary items of expense charged to income	†	†	†
Net income applicable to interest and other charges	$17,335,803	$16,834,733	$18,848,237
Interest charges	2,276,795	1,429,052	768,348
Net income available for dividends and other purposes	$15,059,008	$15,045,681	$18,079,889

*Includes $15,395,846 federal income and excess profits taxes.
†Included in cost of sales.

Gen. Guy E. Tripp, chairman of the board of directors of the company, refers to important changes—affecting the various plants.

"The equipment of the Essington Works with machine tools," General Tripp says, "was completed in the early part of the year, and these works have been wholly engaged in the manufacture of equipment for cargo and naval ships for the United States government. When this work shall have been completed, the original plan to remove the manufacture of turbines and reduction gears from East Pittsburgh to this plant will be carried out, which will make available much needed additional manufacturing space for the other operations of your company at East Pittsburgh.

"The plant of the New England Westinghouse Company at East Springfield will hereafter be devoted to the manufacture of industrial motors and automobile starting and lighting apparatus, which will relieve an overcrowded condition at Newark and certain departments in East Pittsburgh. It is expected that these operations will begin at the Springfield plant about Sept. 1."

In speaking of the fact that the company has been operated during the last year under conditions unprecedented in the industrial world, Chairman Tripp says that the directors "take pleasure in recording their acknowledgment of the devotion and unremitting efforts of the officers and employees."

Among other matters dealt with in the report are the following:

During the year your company acquired the Franklin Electric Manufacturing Company, which was engaged in the manufacture of incandescent lamps at Hartford and Middletown, Conn. The accounts of that company are included in this report as a proprietary company.

The increase in investments is principally due to subscriptions made during the year to Liberty loan bonds. The company and its employees together subscribed to the five government bond issues to an amount in excess of $21,500,000.

Negotiations are in progress for the sale for cash of your company's 5 per cent prior lien debenture bonds of Electric Holdings, Ltd., of London, which were received in payment for your holdings of the British Westinghouse Electric & Manufacturing Company, Ltd.

Every effort has been made to keep the investment in inventories at a minimum amount, with the result that they show a reduction of approximately $1,000,000 as compared with last year.

The current bank loans were reduced during the year by $7,420,000, and the balance of $5,280,000 is being paid as it matures. The accruals for taxes include an estimated amount on income for January, February and March, 1919, calculated under the present federal tax law, which will not be due for payment until 1920. The balance sheet shows ample reserves for the protection of accounts and notes receivable, inventories and other adjustments, substantial amounts having been added during the year.

More than 8000 employees entered the naval and military forces of the United States. During their absence steps were taken to protect their participation in the pension and relief departments, and favorable conditions have been established for the reinstatement of such employees who may apply for positions.

Special interest attaches to the earnings shown in the report because of the recent advance in the rate of dividend on the preferred and common shares from 1¾ per cent quarterly to 2 per cent quarterly.

Signal Corps Overseas Telephone Service

U.S. ARMY SIGNAL CORPS TELEPHONE
CONNECTING WITH 396 SIGNAL CORPS EXCHANGES
IN FRANCE, ENGLAND & GERMANY
SIX EXCHANGES IN PARIS
THIS NUMBER IS ----
SEE DIRECTORY FOR ADDITIONAL INFORMATION

This is from an official photograph showing the card which is attached to every United States Signal Corps telephone overseas. The Signal Corps telephone system overseas has its exchanges in France, England and Germany and connects with 396 different Signal Corps telephone exchanges.

LARGE CONSTRUCTION PLANS FOR SOUTHERN CALIFORNIA

Immediate Hydroelectric Construction Program of Southern California Edison Company—Part of Ultimate Outlay of $125,000,000

A short time ago the Southern California Edison Company completed its new financing for the present year by the sale of $16,000,000 of bonds and debentures, which was the first financing in the West on a large scale since the war was concluded. Announcement is now made by the company concerning the starting of active work on its gigantic hydroelectric construction program which the management has been waiting to inaugurate for some time past.

Twenty million dollars will be required to carry out the plans for the construction of new hydroelectric plants during the next three years, and their completion will mean the development of 66,000 hp. in new hydroelectric plants and an additional annual output of 310,000,000 kw.-hr. The new development on Kern River, 150 miles (240 km.) from Los Angeles, deriving its water supply from the watersheds in Kern and Tulare Counties, has a total installed capacity of 40,000 hp. This plant will be known as Kern River No. 3, the company already having two other plants on the same stream. The new plant will consist of two units of 20,000 hp. each. A feature of the construction will be a tunnel 12 miles (19 km.) long, 8 ft. by 10 ft. (2.4 m. by 3 m.) in dimension. Two pipe lines, each carrying 15,000 miners' inches of water, will require 1500 tons of steel pipe. The water drop will be 800 ft. (240 m.). It is on this project that 2000 men will work for eighteen months, and it is expected that the plant will be put into commission about September, 1920.

THE BIG CREEK PLANTS

Big Creek Plant No. 2, in Fresno County, 240 miles (384 km.) from Los Angeles, is also the scene of active work at the present time. The Big Creek system now consists of two plants with a total capacity of 88,000 hp., each plant containing two 2200-hp. generators. It is proposed to install immediately in Big Creek Plant No. 2 one additional generator of the same size, which will necessitate the construction of an additional pipe line requiring 1100 tons of steel. Later a similar unit will be required at No. 1 power house under practically the same conditions. It is expected that the additional installation at Big Creek Plant No. 2 will be completed and put into commission about the month of April, 1920.

The development of Big Creek Plant No. 3, which will be next in order, will use all the water supplied by Huntington Lake and will utilize it after it passes through the two existing power houses. The combined head of power houses No. 1 and No. 2 is 4000 ft. (1200 m.). Big Creek Plant No. 3 will make available 1350 ft. (405 m.) additional, and a fourth plant, which will be a later installation, will make available another 600 ft. (180 m.), resulting in the water being eventually utilized under a total drop of 5950 ft. (1785 m.). The first development at Big Creek No. 3 of 68,000 hp. will ultimately be increased to over 200,000 hp. The Big Creek Plant No. 3 will, however, not be started until after the completion of the work laid out and now under way for the three-year period.

The three-year program also includes the diversion of other waters in the Big Creek watershed in Huntington Lake, increasing the amount of water available for storage purposes. In later years additional reservoirs and water diversions are to be provided which will very largely increase the amount of water for the Big Creek power houses and justify the construction of additional plants. The immediate construction plans are really a part of a comprehensive program which will ultimately result in the development by the company of 750,000 hp. in hydroelectric plants, requiring an expenditure for plants, lines and substations which will reach a total of $125,000,000.

The service of the company now extends to ten counties in Southern California and the San Joaquin Valley, over 55,000 sq. miles (14,245,000 hectares), serving upward of 200,000 consumers in 233 cities, towns and intervening rural territory. The demand in this extensive region is now larger than ever before, necessitating the immediate construction of the additional water-power plants above referred to, together with transmission and distribution lines to reach agricultural territories and industrial activities now pressing for service.

DISTRIBUTING SYSTEM SALE IN LOS ANGELES

Terms of Proposed Purchase of Electrical Distributing System of Southern California Edison Company by Los Angeles

On May 14 a resolution was adopted by the City Council of Los Angeles authorizing the city attorney to prepare the necessary resolutions calling a special election on June 3, 1919, for the purpose of authorizing an issuance of $13,500,000 in power bonds. Although there will be a general election on the same date, the bond proposal will be on a separate ballot and there will be separate tally sheets for the count of the votes. The same election booths and polling places as are used for the general election will be used for the special election in connection with the bond proposal.

After months of negotiation between representatives of the Southern California Edison Company and the city of Los Angeles in conjunction with E. O. Edgerton, president California Railroad Commission, and Harley W. Brundige, a member of the same commission, an agreement has been reached covering the purchase of the electric distributing system of the Southern California Edison Company in the city of Los Angeles. The purchase price will be $11,000,000, including the physical valuation of the system and $2,453,067 severance damages for taking the business of the Edison company. Payment is to be made by Los Angeles to the Southern California Edison Company in cash before June 30, 1920. The agreement also includes the following details:

The company to make all extensions and betterments pending the final purchase. All money so expended by the company to be added to the purchase price. The company to maintain a depreciation fund of 3.36 per cent on the physical valuation of the system of $8,870,000 plus 3.36 per cent on extensions and betterments pending the conclusion of the purchase. The depreciation fund to be turned over to the city at the time of purchase.

The city agrees not to compete with the company for business in territory outside the city.

The city to purchase power required from the com-

pany in addition to that generated in its own plants for a period of thirty years at a price to be fixed by the State Railroad Commission.

WERE DRIFTING TOWARD COMPETITION

President Edgerton of the State Railroad Commission has made a statement in part as follows in connection with the conclusion of the power negotiations:

The conference has come to an agreement on the sale of the Southern California Edison Company's electric distributing system in the city of Los Angeles for a cash price of $11,000,000. Of course, the final judgment as to whether this purchase will be consummated rests with the people, and the proposal in detail will be submitted to them. After full opportunity for consideration and discussion of this project, the people will have an opportunity to express themselves at an election hereafter to be called, wherein the ratification of the proposed new contract and a bond issue to make it effective will be presented. The people of the city of Los Angeles now have an opportunity to acquire at a reasonable price a complete electric distributing system doing a large and remunerative business.

This conference was first called by me, as president of the Railroad Commission, in August, 1918. The commission realized that there was a rapid drift toward a situation where either the city must allow its electric power generated on the aqueduct to go to waste or it must duplicate the existing distributing systems. This would mean a bitter competitive fight, resulting in serious loss both to the company and the city.

The city was represented by Frederic T. Woodman, mayor, and Albert Lee Stephens, city attorney; the Public Service Commission by Howard Robertson, president; W. B. Mathews, special counsel, and E. F. Scattergood, chief electrical engineer; the City Council by Ralph L. Criswell, chairman public service committee.

The company was represented by W. A. Brackenridge, president; R. H. Ballard, first vice-president; G. C. Ward, second vice-president, and Harry J. Bauer, general counsel.

The meetings of the conference have occurred frequently over a period of nine months, and many days have been consumed in an exhaustive examination of every important phase of the whole question. Each side has been vigilant and aggressive in protecting the interests of its constituents.

The officers of both the city and the company have shown a sincere disposition throughout the entire conference to further a settlement. While I will not attempt in this statement to give the details of the proposed contract, I will state that the city has gained decided advantages in this new arrangement, as may readily be seen by comparing the terms of the old and the new contract. This settlement, if ratified by the people, clears the path of the city of all obstacles to a complete and effective generation and distribution of electric power.

I give it as my unqualified opinion that this settlement is wise, businesslike and equitable. I base this opinion upon my familiarity with this whole subject, gained through presiding over the Southern California Edison Company condemnation case, in which the entire matter of value of plant and business of the company in the city of Los Angeles was exhaustively presented, and through presiding over all of these conferences.

The result of the work of this conference is submitted with the conviction that it will receive intelligent and serious consideration by the people of the city of Los Angeles.

President W. A. Brackenridge of the Southern California Edison Company has made the following statement in connection with the proposed agreement with the city of Los Angeles:

I feel that the consummation of the agreement outlined between the Southern California Edison Company and the city will be a reasonable solution of a number of troubles which have existed for some years past, and should be considered satisfactory to both parties.

While the company will sell its electric distributing system in the city of Los Angeles, it will retain and own all its transmission lines now erected or to be erected within the city limits and will continue to supply the power used within the city for all railway purposes. The city of Los Angeles will be eliminated from competition with the company in territory contiguous or adjacent to the city limits. Further, the city of Los Angeles will require to purchase large quantities of power for distribution and use within the city in excess of power produced by its own plants, and this excess power will be supplied by the Edison company for the next thirty years.

The Edison company occupies a large territory in southern California, and the area is capable of great extension and intensive development. The funds which may be made available by the sale of the Los Angeles distributing system will be put to good advantage in other directions, in the greater development of the territory now occupied and in additions thereto which will be made in the near future.

NEW ADDITION FOR THE GREAT WESTERN SYSTEM

Construction Begins on "Caribou" Plant to Give More Facilities for the Great Western Chain of Stations in California

Construction is beginning on a new hydroelectric plant in the Great Western chain of generating stations in California. The company recently completed the financing by the sale of $6,000,000 in bonds and $1,500,000 in preferred stock. It is estimated that the plant will be completed in about two years' time, the plan being to use the power in the general distribution system around the bay region.

The plant is to be built in the canyon of the North Fork of the Feather River about 9 miles (14.4 km.) above Belden on the Western Pacific Railroad. By means of tunnels both the Lake Almanor watershed and that of Butte Valley will be made available for the new plant. A tunnel about 2 miles (3.2 km.) will be driven from Lake Almanor into Butte Valley, whence water will flow into Butte Creek channel to a point near the junction of the north fork of the Feather River, where a dam is to create a small reservoir. A second tunnel, about 2 miles long, will be driven from this reservoir to a point directly above the power house, whence a 1100-ft. (335-m.) head will be made available through steel penstocks in rock tunnels. Water discharged from the Caribou Plant into the north fork of the Feather River will be used again at the Las Plumas plant, which is about 40 miles (64 km.) further down the river.

For the present the power house is to contain two 20,000-kw. units with transformer equipment for stepping up to 160,000 volts. The probable ultimate capacity of the plant, it is stated, will be 120,000 kw., with a possible increase to 136,000 kw. A 150,000-volt steel tower line is to be built from the Caribou plant to a point on the north shore of Carquinez Straits. For a considerable distance this line will parallel the existing 100,000-volt line from Las Plumas to Oakland.

Because of the 300,000-acre-feet storage capacity at Big Meadows and Lake Almanor, together with the high natural run-off from the Butte Valley watershed, it is expected that the new plant can be operated at a high percentage of installed capacity. This plant is part of a comprehensive scheme whereby the Great Western Power Company expects to develop a total of 635,000 hp. in plants above Oroville in the Feather River basin.

SAMUEL INSULL COMMENTS ON HIS EUROPEAN TRIP

On His Return to the United States He Is Optimistic as to Outlook for Successful Business in England

"There are tremendous problems for the British to solve now that the war is over," said Samuel Insull, who has recently returned from a trip to Europe lasting about two months. "The industrial position may have been causing some anxiety, but the attitude of conciliation which seems general on the part of both capitalists and employees would seem to indicate that a solution will be found for labor problems.

"The spirit of the people is encouraging. I have never seen so little evidence of poverty or drunkenness in London as during this last visit, and I was there through the Easter holidays. Manifestations of this sort are hardly the forerunners of Bolshevism. It appears to me that a revival, and indeed an increase, of British export business is purely a matter of production.

"America does not know that she has been at war, and the American business man who thinks he sacrificed to the limit for his country's cause and is proud of the burdens he carried would trade his pride for humility could he visit the business centers of Europe and learn what the war cost industry and commerce there."

BYLLESBY COMPANY BECOMES AN OIL UTILITY CONCERN

Combination of Standard Gas & Electric with Shaffer Oil Companies Is Occasion for New Financing

The Standard Gas & Electric Company, the principal holding company managed by H. M. Byllesby & Company, Chicago, has acquired by consolidation the oil and refining interests of C. B. Shaffer and associates. A new company, the Shaffer Oil & Refining Company, of which Mr. Shaffer will be president and H. M. Byllesby chairman, has been formed to take over the property.

The Standard Gas & Electric Company was incorporated on April 28, 1910, and owns bonds, stocks and other securities of public utility systems serving 460 communities, with a total population of approximately 2,200,000, situated in sixteen Western states. The capitalization of the Standard Gas & Electric Company was as follows:

	Authorized	Issued	Retired and Canceled	Outstanding
Convertible 6 per cent bonds, due 1926	$30,000,000	$11,800,000	$4,687,000	$7,113,000
Collateral trust 7 per cent notes, due Sept. 1, 1921	750,000	750,000	.....	750,000
6 per cent scrip, due 1923	1,649,893	1,649,893	1,447,230	202,663
Twenty-year 6 per cent gold notes, due 1935	15,000,000	6,841,200	.....	6,841,200
Preferred stock	30,000,000	.....	.....	11,784,950
Common stock	15,000,000	.....	.....	9,343,150
Total	.....	.....	.....	$36,034,963

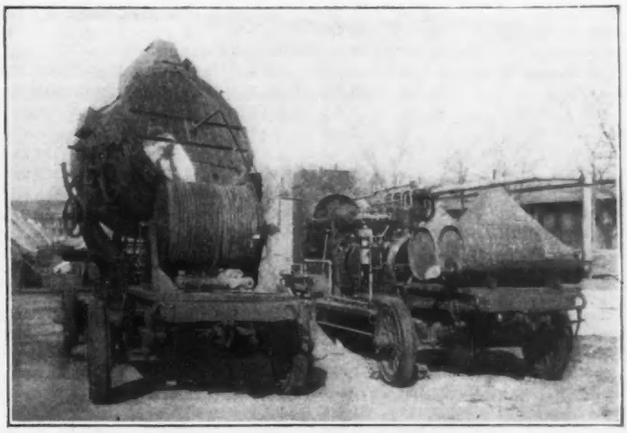
The oil properties which are turned into the consolidation comprise approximately 57,800 acres of fee and leasehold oil lands, pipe lines, a refinery and a marketing organization with the Deep Rock brand for refining products. The oil lands lie in Kansas and Texas, on which there are wells with an average daily production of around 4200 barrels. The refinery has a capacity of about 6000 barrels per day. The properties also include steel tanks and 508 modern steel tank cars. The capitalization of the Shaffer Oil & Refining Company, the new concern, is as follows:

	Authorized	Outstanding
First mortgage convertible 6 per cent sinking-fund gold bonds, due June 1, 1929 (this issue)	$15,000,000	$12,000,000
Participating preferred 7 per cent cumulative stock $100 par	50,000,000	11,000,000
Common stock (shares of no par value)*, shares	500,000	200,000

*Standard Gas & Electric Company will own a majority of the shares of common stock, which will have sole voting power.

As a first step in financing, the $12,000,000 Shaffer Oil & Refining Company first mortgage convertible 6 per cent sinking-fund gold bonds, due June 1, 1929, are being offered to the public at a price of 95 and interest. These bonds, in denominations of $1,000, $5,000 and $10,000, are callable at various prices from 102 to 103 and interest, or are convertible at par into participating preferred 7 per cent cumulative stock of the Shaffer Oil & Refining Company at 105. The issue has been purchased by H. M. Byllesby & Company, Montgomery & Company and Bonbright & Company.

Motor Equipment of United States Army Engineer Corps



In the Victory loan parade at New York various floats illustrated the great flexibility of the motor truck as developed for use in the Engineer Corps of the army. The cut on the left shows a machine shop on wheels; that on the right shows a 60-in. barrel-type searchlamp. These are only two of a dozen or more uses to which the army motor truck has been put.

FEDERAL GOVERNMENT'S DATA ON ENERGY SUPPLY

Report on the Production of Electric Power Compiled by the Geological Survey for the Month of February, 1919

This report, prepared by W. B. Heroy, is based on returns received from 3150 electric power plants engaged in public service, including central stations, electric railways and certain other plants the output of which contributes to the public supply. Mr. Heroy is chief of the division of power resources of the United States Geological Survey. Dr. George Otis Smith, director of the Geological Survey, writes that it is hoped to issue such a report each month. The returns received represent about 85 per cent of the total generating capacity. For plants which did not make returns or which were unable to furnish the data requested estimates of output were made from available information. The output for the month averages 110,000,000 kw.-hr. per day, of which 39 per cent was produced by water power.

State	Thousands of Kilowatt Hours Produced: By Water Power	By Fuels	Capacity (Kw.)	Combustion of Fuels: Coal, Short Tons	Petroleum and Derivitives, Barrels	Natural Gas, Thousands of Cubic Feet
Alabama	39,372	12,939	165,688	30,164	0	0
Arizona	3,967	16,395	91,363	483	109,450	0
Arkansas	77	6,275	32,358	13,267	442	0
California	190,462	38,295	852,956	0	199,074	0
Colorado	13,161	17,271	131,027	40,980	1,896	0
Connecticut	12,419	38,643	252,130	61,745	333	20,766
Delaware	0	5,549	20,617	8,590	0	0
Dist. of Columbia	0	18,094	66,450	21,418	0	0
Florida	678	11,257	59,304	3,424	25,084	98
Georgia	35,497	7,236	214,250	14,088	120	0
Idaho	42,050	259	115,439	125	10	0
Illinois	13,701	241,930	804,329	360,806	1,004	0
Indiana	3,761	56,151	319,348	152,218	436	2,160
Iowa	44,214	23,110	291,635	136,896	798	0
Kansas	1,267	29,203	156,114	46,987	40,543	67,937
Kentucky	4	18,900	104,889	41,636	381	0
Louisiana	0	14,034	52,639	14,240	30,788	55,092
Maine	16,611	132	92,927	525	7	0
Maryland	278	18,[illegible]8	128,879	28,317	159	1,500
Massachusetts	19,1[illegible]7	[illegible],844	748,698	133,965	21	0
Michigan	49,9[illegible]0	97,187	476,913	127,362	117	0
Minnesota	24[illegible]5	28,708	292,935	64,400	1,003	0
Mississippi	0	5,789	34,315	16,177	410	0
Missouri	4,297	37,212	291,170	84,472	32,198	0
Montana	69,220	1,552	237,476	5,008	539	1,008
Nebraska	810	16,022	90,462	29,237	5,488	0
Nevada	2,913	137	10,630	198	900	0
New Hampshire	4,660	2,188	47,938	5,205	20	0
New Jersey	165	79,153	343,214	107,035	95	121,000
New Mexico	59	1,272	12,830	2,875	1,060	0
New York	204,590	288,986	1,836,029	367,508	380	458,233
North Carolina	43,234	2,820	172,217	8,456	20	0
North Dakota	0	2,308	20,939	15,875	547	0
Ohio	2,309	181,766	829,161	313,309	786	271,454
Oklahoma	223	12,092	68,013	10,705	8,140	377,988
Oregon	27,034	3,259	112,008	139	14,716	0
Pennsylvania	55,066	243,098	1,132,174	443,892	15	53,045
Rhode Island	383	28,767	159,175	29,692	0	0
South Carolina	64,745	3,235	195,192	8,971	62	0
South Dakota	4,624	3,751	34,449	12,653	3,321	0
Tennessee	43,780	8,368	170,272	24,161	61	0
Texas	165	43,151	202,101	25,800	171,374	173,960
Utah	48,906	0	76,832	0	0	0
Vermont	13,777	209	86,071	642	0	0
Virginia	17,693	17,685	186,150	30,503	132	0
Washington	71,160	5,667	275,802	23,381	1,989	0
West Virginia	1,453	51,584	187,556	60,120	7	86,276
Wisconsin	28,284	32,709	351,215	65,901	584	0
Wyoming	251	3,542	21,031	13,264	8,260	2,884
Total	1,220,972	1,879,182	12,665,309	3,007,815	662,770	1,693,401
Combined total		3,100,154				

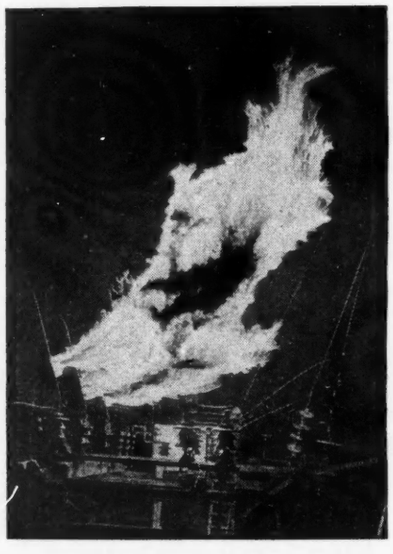
APPROPRIATIONS FOR THE POWER SURVEY ARE ASKED

Now Before Committee of the House of Representatives in Same Form as at the Last Session of Congress

With the opening of the Sixty-sixth Congress the movement to obtain appropriations for a power survey of the United States is again under way. The estimates of appropriation presented by Secretary Lane of the Department of the Interior to the last Congress have been renewed and are now before the appropriations committee of the House of Representatives. These appropriations, which, owing to the filibuster at the close of the last session, failed of passage, will, if made, permit the Geological Survey to expend $250,000 in studies of power supply during the coming fiscal year. Of this amount $50,000 is to be used in a general engineering and statistical survey of power resources.

The appropriations committee of the House of Representatives will probably begin consideration of the various items to be included in the sundry civil bill during the first week in June, and the power survey estimates will doubtless be brought to the attention of the committee. Director George Otis Smith of the Geological Survey expects to be called before the committee to explain the objects to be accomplished by the power survey. The committee is not fully organized and contains several new members who will doubtless need to be informed concerning the proposed work. Representative James W. Good of Iowa is the new chairman of the committee, having been the ranking Republican member next to Representative Gillette, who became Speaker of the present House.

An Arc Eighteen Feet Long



What happens when air-break knife switches are opened under no load and with only charging current flowing in the Tallulah-Atlanta (Ga.) 110,000-volt transmission line is shown in this picture. It was made in the night at Gainesville, by G. A. Iler, on the property of the Georgia Railway & Power Company. As can be seen readily from the picture, extra-wide spacing between phases would be required to prevent the arc drifting across all three phases and short-circuiting the line if such switching were regular practice. The arc is about 18 ft. (5.4 m.) long.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

International Association of Municipal Engineers.—The annual convention of this association will be held at Chicago, Sept. 23 to 26.

A. S. M. E., Baltimore Section.—"Oil Engines" was the subject of a paper by Leon Wygodsky and "Boiler Explosions" that of R. E. Munno at the April 29 meeting of this section of the American Society of Mechanical Engineers.

Electric Club of Chicago.—Motion pictures visualizing sound waves and electric currents and showing how the telephone talks were shown at the club's May 8 meeting, when Jam Handy of the Bray Studios, New York City, spoke on "Motion Pictures in Business."

Western Society of Engineers.—One hundred and forty-five members and guests of the Western Society of Engineers, Chicago, visited the Buffington plant of the Universal Portland Cement Company on May 10. The power station at this cement plant was of particular interest to engineers on account of the liberal use of concrete in the design.

National District Heating Association.—The annual convention of this association is to be held at the William Penn Hotel in Pittsburgh, Pa., on June 10, 11, 12 and 13, 1919. Exhibits have been arranged by a number of manufacturers for this meeting, which is to be held in conjunction with the summer meeting of the American Society of Heating and Ventilating Engineers in the same city.

I. E. S., Philadelphia Section.—At the May 16 meeting of this section of the Illuminating Engineering Society Dr. George A. Hoadley presented a paper entitled "The Relation of the Illuminating Engineering Society to Its Members," and Preston S. Millar spoke on "The Prospects and Possibilities of the Future." Many helpful ideas for the next year's work were advanced in the discussion which followed the prepared program.

New York Electrical Society.—A. M. Nicholson, Research Laboratory, General Electric Company, gave an illustrated lecture on "Speaking Crystals" at the May 26 meeting, explaining how common crystals can be utilized to transmit speech, music and sound. E. B. Craft, assistant chief engineer of the Western Electric Company, lectured on "War Developments in Electrical Communication, on Land and Sea and in the Air."

Jovian Electric League, Los Angeles.—S. M. Kennedy, general agent Southern California Edison Company, spoke on "The Man in the Street" at the May 14 meeting of the league.

New York Electrical League.—The monthly luncheon of the New York Electrical League, held on May 27, was addressed by the Rev. W. Warren Giles, who had for his subject "After-Thoughts on the Great War for Business Men."

Oklahoma Company Employees Organize Club.—At the first meeting of the Oklahoma Gas & Electric Company's Employees' Club, held on April 29, George B. Saunders was elected president and Miss Katherine Pierce was chosen secretary-treasurer.

Institute of Radio Engineers.—"Naval Aircraft Radio" is to be the title of a paper which T. Johnson, Jr., expert radio aid of the United States Navy, will present at the next meeting of the Institute, to be held on June 4 at 8.15 p.m. in the Engineering Societies Building, New York City.

West Virginia Public Utilities Association.—This association will hold a convention at White Sulphur, W. Va., from June 4 to 7. Electric light, power, railway and telephone men, as well as manufacturers of electrical equipment, will be represented. This will be the first convention of the organization since the beginning of the war.

Cleveland Electrical League.—The league is planning to hold its annual election and dinner on June 7 at 6.30 p.m. in the Hotel Statler ballroom. F. A. Wilson-Lawrenson, assistant to the president of the Union Carbide & Carbon Corporation, New York, spoke on "With Colonel Younghusband to the Sacred City Thassa" at the regular noon meeting on May 22.

American Institute of Electrical Engineers

Lynn Section.—Colonel James M. Andrews, 105 Infantry, U. S. A., gave some "Random Remarks on the 105th Infantry in France" at the meeting of May 28.

Boston Section.—"Utilizing the Time Characteristics of Alternating Current" was the subject of Henry E. Warren, who spoke at the annual meeting of the section held May 6.

Pittsfield Section.—Dr. George Otis Smith, directors United States Geological Survey, Washington, D. C., spoke on "America's Peak Load" at the annual dinner held May 28.

Fort Wayne Section.—A series of talks on fractional-horsepower motors were given by E. B. George, Roy Young, E. A. Schaefer and R. B. Roberts of the fractional-horsepower engineering and commercial departments, Fort Wayne Works of the General Electric Company, at the April 17 meeting.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Surcharge Allowed in California.—The Northern California Power Company has been granted authority by the Railroad Commission to add a surcharge of 10 per cent to its charges for electricity. This is less than one-half of the increase asked by the company, which asked increases of 14 to 25 per cent. The surcharge will not be applied to the rates for energy sold in that part of Butte and Colusa Counties where it competes with the Pacific Gas & Electric Company, those rates having been adjusted in a previous decision by the commission. Neither will it affect the rates charged by the company as a result of the tri-party contract which provides for the transfer over its system of power received from the California-Oregon Power Company for the Pacific Gas & Electric Company. The surcharge went into effect with the meter reading on May 1. When the rates for the company were fixed by the commission in decision No. 3624 there was excluded from the valuations property worth $1 336,773, held at that time to be non-operative and therefore not to be considered in the rate adjustment. Since 1918 this property has been fully devoted to the use of the consumers in addition to capital additions of $801,295 made between Sept. 30, 1915, and Nov. 30, 1918. Averaging the conditions in 1917 and 1918 "and what may reasonably be anticipated for 1919," the commission arrives at $973,043 as the average gross revenue received in this period—an allowed charge of $100,000 for maintenance, $180,000 for operation, $59,990 for taxes and $102,000 for depreciation. Deducting a total expense of $441,990 gave a net income of $531,453, or 7 per cent upon $7,595,385, the average capital for the three years. Under the conditions prevailing in 1919 the commission holds that the expenses for maintenance and operation will be increased to $531,990, and the net income from the present rates available for return would be only $441,053. With an increase in revenue of 10 per cent and making due allowance for the increase in taxes which will follow, the company will earn, on the basis of the average three years' revenue, a net of $532,508, available for return, which is 7.02 per cent of average capital for three years. If the surcharge be applied to the probable revenue for the year 1919, the company's net return will amount to $537,947, which corresponds to a return of 6.63 per cent upon the estimated capital of $8,116,007 for the year 1919.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Discuss Lighting of Air Ports.—W. D'A. Ryan of the General Electric Company, who had charge of the lighting effects at the Panama-Pacific Exposition at San Francisco, headed a delegation from the National Electric Light Association which discussed the science of illuminating air ports with members of the second Pan-American Aëronautical Congress at Atlantic City last week. The plan under consideration had to do with the illumination of the terrain to a sufficient degree to bring out its essential features, such as runways, ground hazards, wires and buildings, together with the limitations of the field, so that the flier may know how much space is available for landing.

Municipal Plant Operations in Cleveland.—In a recent interview Lighting Commissioner Davis of Cleveland said that the municipal plant showed practically no earnings in 1918. "All items of expense are not yet completed." Mr. Davis said, "but to all evidence we will come out even. The year 1919, in view of delay in construction of extensions to the plant, will be the most critical in the history of its municipal ownership. If we keep 3-cent light this year, it will be safe for all time. The figures for 1918 will show that our gross receipts were $1,600,800, of which $350,000 accrued from the sale of bonds for extension work. Our operating expense was $176,086 and maintenance $174,-124. Depreciation on the property was $155,092. We sent the sinking fund $109,795 for the retirement of bonds."

A New Electric Car Record.—Making the 124.6-mile trip in five hours and thirty-nine minutes, a passenger car of the Baker R & L Corporation has bettered by eighteen minutes the old electric vehicle record between New York and Atlantic City. The old record, made by a car of the same type, was five hours and fifty-seven minutes. It had stood since 1917. The trip was made under the auspices of the New York Electric Vehicle Association and in conjunction with the annual convention of the National Electric Light Association. Herbert Mould was the official observer, while De Peyster Stagg drove the car. The speedometer reading showed an actual mileage of 124.6. The energy consumption averaged 2.6 amp.-hours per mile and the speed averaged 22½ miles per hour. The trip was made by way of Staten Island and Lakewood, with a stop at the latter place at luncheon time for a battery boost.

Urges International Committee on Fuel Conservation.—Conservation of fuel was advocated by the International Parliamentary Commercial Congress, which met at Brussels the third week of May. The congress adopted a resolution inviting the Allied and associated governments to appoint an international committee with the object of centralizing information relating to fuel production, transportation and consumption.

No Wage Reductions, Illinois Labor Head Says.—John H. Walker of the Illinois State Federation of Labor, in a statement as to the attitude of labor regarding wage reductions, says: "Organized labor will oppose vigorously any attempt to reduce wages, whether by public utility corporations or by employers engaged in private enterprise. . . . I do not know whether rates charged by public utility companies are adequate to maintain the higher wage rate, but if they are found inadequate after investigation, then the rates should be increased sufficiently to guarantee the workers against wage reductions."

John Fritz Medal Presented to General Goethals.—The John Fritz medal, awarded for achievement in some branch of engineering, was presented to Major General George W. Goethals in recognition of his work as builder of the Panama Canal, at a meeting in the Engineering Societies Building, New York, on May 22. The presentation was made by Ambrose Swasey, past-president of the American Society of Mechanical Engineers. The speakers included Henry L. Stimson, former Secretary of War, and W. L. Saunders, past-president of the American Society of Mining and Metallurgical Engineers, who extolled General Goethal's work in high terms.

Doherty Men's Fraternity.—The organization committee of the Doherty Men's Fraternity is about ready to send out membership forms to employees of the concern. The applicant recognizes that membership in the fraternity demands of him: "(a) That I will study the principles upon which my country, of which I am a citizen, was founded, promote their continuance and do all that I can to destroy disloyalty to them. (b) A sincere belief in the business policies and business philosophy of Henry L. Doherty. (c) My best efforts to make the character, quality, merit, service, reputation and external appearance of all Doherty Company properties excel that of all contemporaries. (d) That I will strive as though the sole support of the standing of the Doherty Organization depended upon my own efforts. (e) That I will be kind and loyal to the men who supervise my work and to those whose work I supervise." The committee consists of B. C. Adams, W. J. Barker, M. R. Bump, F. R. Coates, S. B. Irelan, F. M. Lowry, H. R. Straight, R. A. Wotowitch and George Williams. A large membership of company employees is looked for.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Tampering with Meters.—Indictment charging interference by defendant with the sealing and testing of electrical meters by deputy and assistant state sealers of weights and measures, in violation of statute, the Supreme Court of Tennessee has held, is sufficient without stating the location of the meters alleged to have been changed or tampered with by defendant and the manner in which they had been changed or tampered with by its agents (210 S. W. 630).

Rights Conveyed in Deed for Flooded Lands.—The Supreme Court of Minnesota has held that the words "said dam may maintain the water at a height of seven feet," contained in a deed conveying 2.3 acres upon which was a mill dam, did not create an easment giving the grantees the use of a swale some 700 ft. above the premises conveyed for a permanent spillway. Nor did the deed by implication grant a right-of-way over the grantor's land above the tract conveyed to repair the erosion in the sod of the swale, where the waters in times of floods enter from the stream and threaten to cut a new channel. Even if defendant's first entry upon plaintiff's land might be held justifiable because of an unexpected emergency threatening destruction of private property, subsequent repeated entries, when the threatened destruction could not be said to arise from unexpected emergencies, must be held wrongful (171 N. W. 782).

Rights of Contiguous Owners on Streams.—The Court of Appeals of Kentucky has brought out the following points on rights of owners on a stream: (1) An upper proprietor has an easement in the land of the lower proprietor for the escape from his land of both surface water and that running in natural streams, which right the lower proprietor may not interfere with. (2) An upper proprietor cannot collect surface water into a volume and empty it upon the lower proprietor, nor can he by such means augment the flow of a natural stream so as to damage his neighbor below. (3) The essential fact entitling the plaintiff to the relief he sought having been put in issue and determined by the chancellor against him upon sufficient evidence, the court on appeal must affirm the judgment. (4) Where the evidence is conflicting and the mind is left in doubt as to the truth, some weight will be given by the court on appeal to the finding of the chancellor in the original trial (210 S. W. 163).

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Ralph D. Cutler has been appointed sales manager of the Hartford (Conn.) Electric Light Company.

Dr. A. E. Kennelly of Harvard University and the Massachusetts Institute of Technology has served as acting head of the electrical engineering department since the early part of 1918, when Prof. Dugald C. Jackson entered the service as major in the Engineers' Reserve Corps. Through error, it was stated in the May 17, 1919, issue of the ELECTRICAL WORLD, in connection with the return of Professor Jackson to the Institute, that Prof. R. R. Lawrence had been acting head of the electrical engineering department.

Dr. William McClellan, who resigned recently as dean of the Wharton School of Finance and Commerce of the University of Pennsylvania, has been elected vice-president of the Cleveland (Ohio) Electric Illuminating Company. Dr. McClellan is a graduate of the University of Pennsylvania, and his technical experience covers a wide range of important work, including that of engineer in charge of construction of the Philadelphia Rapid Transit Company, supervising engineer with Westinghouse, Church, Kerr & Company, member of the firm of Campion & McClellan, and chief of the division of light, heat and power of the Public Service Commission for the Second District of New York.

WILLIAM M'CLELLAN

Brig.-Gen. George H. Harries, a vice-president of H. M. Byllesby & Company and formerly president of the Louisville (Ky.) Gas & Electric Company, has recently been twice honored on account of services rendered during the war. The American distinguished service cross has been conferred upon him by General Pershing in recognition of his services at Brest in the early part of the war. He has also been made a commander of the Legion of Honor by General Dupont of the French army as a further recognition of his work at Brest. General Harries was the first American officer in Berlin as the American member of the Inter-Allied Commission on the Repatriation of Prisoners of War. He assisted in the return not only of American prisoners but of those of Greece, Serbia, Rumania and Russia.

W. C. Hall of Kokomo, Ind., has been appointed superintendent of the municipal light and water plants of Anderson, Ind.

Major Ezra B. Whitman, of the firm of Norton, Bird & Whitman, Baltimore, Chicago and New York, until recently officer in charge of utilities, Quartermaster Corps, Camp Meade, Md., sailed on May 16 with a party of technical and financial experts for Poland. He has been engaged by interests in Poland to investigate municipal, sanitary and power matters and general developments for various cities in that country. Major Whitman will be away about three months, during which time he will visit and make reports on all the larger cities of Poland.

A. Emory Wishon, who was elected president of the Pacific Coast Section of the N. E. L. A. recently, is assistant general manager of the San Joaquin Light & Power Corporation, Fresno, Cal. Mr. Wishon was born at St. James, Mo., July 10, 1882. His father, A. G. Wishon, now general manager of the San Joaquin Light & Power Corporation, was one of the pioneers in hydroelectric development on the Pacific Coast. The first power plant that he promoted and built was the Mount Whitney No. 1 plant. This was in 1899. Since that time A. G. Wishon has continued in the financing, building and operating of hydroelectric plants in the San Joaquin valley, and he is largely responsible for bringing into prominence electrically operated agricultural pumping plants that have turned the arid plains of this valley into fertile producing farms. A. Emory Wishon took up electrical work at the Mount Whitney plant No. 1. He started as an oiler there and worked in different operating capacities before entering the Missouri School of Mines, from which he was graduated in 1908. For a number of years after returning to California he devoted his attention to the introduction of electric power in the oil fields with marked success. In 1910 he was placed in charge of the Southern division of the San Joaquin Light & Power Corporation, which included oil fields, agricultural districts, street railways and gas properties. In 1912 he was made assistant general manager and transferred to the main office in Fresno.

George M. Guilford has been appointed auditor of the Edison Electric Illuminating Company of Boston, Mass., succeeding the late L. M. Wallis.

Philip Cabot of Boston, Mass., has resigned as president of the Turners Falls Power & Electric Company. The completion of his plans for the development of the important steam and hydroelectric system of the company leaves Mr. Cabot free to devote himself to other interests. He is a member of the banking firm of White, Weld & Company of Boston and has attained the reputation of being one of the most advanced thinkers in the central-station industry in New England. To his constructive work in the development of the Turners Falls property was due largely the ability of the system to meet the demands of war industries in its section for power during the war. For a long period he has devoted his time to the solution of the larger problems of hydroelectric power economics and water conservation, including questions of interstate coöperation with regard to storage development.

PHILIP CABOT

William S. Murray, well known as the chief electrical engineer of the New York, New Haven & Hartford Railroad for many years, who has heretofore maintained headquarters at New Haven, Conn., has moved his engineering offices to 165 Broadway, New York City. He will devote his time to consultation on electrical generation and transmission, railroad electrification, and conservation of natural resources. Mr. Murray's connection with the New York, New Haven & Hartford Railroad covered the period from April, 1905, to December, 1916, during which time the single-phase electrification took place. For the first part of this time Mr. Murray was directly connected with the electrical engineering department, and during the latter part of the time he acted as consulting engineer, as a member of the firm of McHenry & Murray, now dissolved. More recently he has served as president of the Hoosatonic Power Company of New Haven.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

MOVE FOR GUARANTEE ON FLASHLIGHT BATTERIES

Manufacturers Feel that Action Along This Line Will Go Far Toward Gaining and Holding the Confidence of the Public

Because flashlight batteries depreciate while inactive upon the dealers' shelves, misunderstandings frequently arise when the buyer gets a battery that has been in stock for many months. The dealer is not always careful to dispose of his old stock completely before he sells from the fresh invoice.

Generally speaking, all flashlight batteries are of a good quality, and consequently there is no reason for any reputable manufacturer to fear the effects of a guarantee. Manufacturers for the most part are in favor of guarantees on shelf depreciation and minimum burning life and for as long a time in each instance as possible.

It is stated by manufacturers that the length of time which a battery may remain inactive and not depreciate 10 per cent varies with the size of the battery, the smaller battery depreciating more quickly. Consequently different guarantees would have to accompany different sizes. Various sizes, it is held, could be rated from three months to a year.

Some definite proposals in this matter are expected from the manufacturers in the near future. It is the consensus of opinion that a stand taken for liberal guarantees will go a long way toward gaining and holding the confidence of consumers.

CONSIGNED LAMP STOCKS NOT ABNORMALLY LARGE

Special Sizes and Types High in Some Localities— Dealers' Indifference Tends to Cause Excess Stocks

There has been a report that stocks of lamps consigned to jobbers in a certain section of the country were large and that steps were being taken to reduce them. Investigation shows that stocks are not as a rule abnormally large in the 40, 50 and 60-watt sizes, which are those that enjoy a steady market for household and commercial use with a three or four weeks' turnover. Stocks of tungsten vacuum and gas-filled lamps, it is stated, are slightly above normal in some sections. However, these stocks are not alarmingly large and exist because of the natural lengthening of daylight hours and also in a certain measure because of the daylight-saving law.

When jobbers' accounts on manufacturers' books show excess stocks it is becoming more and more the practice among manufacturers to investigate the case and either remove the excess or assist the jobber to create a market for that excess. Instances are too common where jobbers have little regard for their excess consigned stock, as it costs them little except storage space to carry it. The manufacturer is interested in eliminating slow stock, and when found it is generally shipped to a central warehouse or to a jobber who is in a position quickly to dispose of such a stock.

The case of one jobber showing excess stocks was investigated and the lamps were returned to manufacturer's warehouse. The jobber had been supplying a manufacturer of a commercial article with a special lamp which could be used virtually for only one purpose. The demand for this article decreased, and the jobber was left with a supply of this special lamp; but his books showed an excess stock sufficient for investigation.

Other instances concern dealers in certain localities with a stock of the larger types of lamp for which the demand is light and extremely intermittent. A dealer with an order for, say, ten lamps of a large size orders a case. The excess after this order has been filled has been known to lie in stock for a year or so and finally to be gathered in by the manufacturer. In the case in mind the dealer had an order for this stock the day after its removal. This could not be helped; it had stayed too long on the shelf.

MARCH INSULATED-WIRE EXPORTS AMOUNT TO $1,025,867

Month's Foreign Shipments of Electrical Goods, $7,876,353, Bringing Figures for First Quarter Up to $22,164,966

During March last the exports of insulated wire and cable went over $1,000,000 for the first time, the total being $1,025,867. March was another electrical export month, shipments amounting to $7,876,353.

Besides insulated wire and cable, batteries, generators, fans and heating and cooking appliances hung up new records The value of batteries exported was $579,708; generators, $390,765; fans, $269,934, and heating and cooking devices, $151,693. March was the first month in which the last item has reached the $100,000 mark so far as the records show.

Figures for the first quarter of the current year amount to $22,164,966, or 67.3 per cent more than the total for the first three months of 1918. At the present rate the exports of electrical merchandise should run close to $90,000,000 for 1919.

The figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce:

	March		Nine Months Ending March	
	1918	1919	1918	1919
Batteries	$289,251	$579,708	$2,502,333	$2,949,375
Carbons	181,617	98,923	1,163,653	1,264,900
Dynamos or generators	269,409	390,765	1,803,378	2,737,755
Fans	65,643	269,934	428,419	868,642
Heating and cooking apparatus	31,553	151,693	397,352	730,228
Insulated wire and cable	550,738	1,025,867	4,589,088	5,634,426
Interior wiring supplies including fixtures	129,703	172,622	1,116,983	1,247,571
Arc lamps	2,001	308	9,703	10,691
Carbon-filament lamps	8,840	14,039	122,952	103,768
Metal-filament lamps	236,817	426,128	2,119,690	3,047,945
Magnetos, spark plugs, etc.	318,333	321,499	2,608,501	2,197,181
Meters and measuring instruments	125,207	273,373	1,064,740	1,804,590
Motors	785,233	838,448	4,942,714	7,468,602
Rheostats and controllers	29,429	38,565	144,568	273,753
Switches and accessories	222,338	225,305	1,729,180	1,583,413
Telegraph apparatus including wireless	15,429	60,186	214,132	495,726
Telephones	368,338	255,154	1,867,423	2,046,298
Transformers	203,446	449,077	1,507,914	3,349,631
All other	1,334,087	2,284,759	11,608,387	16,457,312
Total	$5,167,412	$7,876,353	$39,941,110	$54,271,807

THE DOMESTIC AND EXPORT TRANSFORMER MARKET IMPROVING

Increased Line Extensions and House-Wiring Campaign Bring Better Volume of Sales and Inquiries from Central Stations

The transformer market is reviving under the stimulus of business expansion throughout many parts of the country. Orders from the Middle West are active, the Pacific Coast is buying somewhat more freely, and the East is falling into line with increasing inquiries and better sales. Within a month one Middle Western central station has ordered no less than 54,000 kva. in transformers. Foreign business, notably from Spain and Norway, shows healthy gains, these being due largely to hydroelectric developments. Although much more building is to be started later in comparison with the present low volume, central stations are increasing their line extensions in many localities; house-wiring campaigns are yielding good results, and inquires are comng into the transformer factories at an unsurpassed rate.

METAL MARKET SITUATION

Copper Has Receded Slightly and Sales Have Decreased in Volume

The buying spurt of copper of a week ago has fallen to some extent, but transactions are reported in good volume. The price of spot has declined since last week ¼ cent to 16.37½ cents, while the qotations of 16.75 cents, which then prevailed for June and July, have declined to 16.50 cents a pound.

Much of the copper recently sold went to electrical manufacturers, so that now the needs of this group are apparently covered for a short time. Wire-drawers purchased heavily on account of some recent orders for bare wire for transmission lines. This should merely be the beginning of such buying, as this work has received little attention for the last two years, and much interconnection of power lines is contemplated.

The London market is off nearly £1. Large exports of copper-wire bar to England have been reported, although that country already has heavy stocks of ingots. Antimony has increased ⅛ cent to 8.37½ cents, but little activity in the market is apparent. On the other hand, spot spelter has declined a fraction and its market is likewise quiet.

Most of the scrap metals have jumped up slightly, but there have been no large volumes of sales. Aluminum still appears to hold the most attention, although zinc and lead scrap are finding fair sales.

NEW YORK METAL MARKET PRICES

	May 20	May 27
Copper:	£ s d	£ s d
London, standard spot	79 5 0	78 15 0
	Cents per Pound	Cents per Pound
Prime Lake	17.00	17.00
Electrolytic	16.75	16.37½
Casting	16.00	15.87½
Wire base	18.00 to 18.50	18.00 to 18.50
Lead, trust price	5.25	5.25
Antimony	8.00	8.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.65	6.57½
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	32.00 to 33.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13.75 to 14.25	14.00 to 14.25
Brass, heavy	7.75 to 8.25	8.00 to 8.50
Brass, light	7.00 to 7.25	7.25 to 7.75
Lead, heavy	4.37½ to 4.50	4.50 to 4.60
Zinc, old scrap	4.50 to 4.75	4.50 to 4.75

THE WEEK
IN TRADE

BETTER business in electrical lines is reported for the week. Wiring materials, labor-saving devices, portables, particularly those with silk shades, and fixtures are moving very well.

A number of advances in price are reported, including 20 to 25 per cent on non-metallic conduit, $3 per 1000 ft. on flexible armored conductor, and increases of a substantial nature in brass, push sockets and insulating cloths and oils. Wire advanced on Tuesday, due to higher copper and cotton-yarn prices. Much of the advance this week was due to the skyrocketing of cotton.

Collections appear to be holding up well.

NEW YORK

During the past week there has been evidence of returning confidence, and this has been reflected in a somewhat better tone to the jobbing and manufacturing trade. The impression is prevalent that better business is just ahead, and the expectation is that the latter part of the summer will see industries well on toward full swing.

Evidences of increased building and construction are found in all sections. Crane manufacturers have reported increased inquiries from stoneyards, showing the latter's preparations for renewed building. The house-wiring campaign of the Brooklyn Edison Company is reported very successful for April and May, and it is its intention to put on a store-wiring campaign in August and September.

Jobbers' reports this week are better than last week, and their reports on collections continue to show improvement. No new requests for extensions of credit have been found.

There is reported $200,000,000 worth of new construction on the drawing boards scheduled for New York City.

WIRE.—Rubber-covered base advanced on Tuesday from 20 to 21 cents because of higher copper and cotton yarn costs. Producers held off until it was felt that the rise in copper was not a fluctuation.

INSULATING MATERIALS.—Insulating cloths and oils are up considerably and advancing. Cloth is following the cotton market fairly regularly.

NON-METALLIC CONDUIT.—Advances of 20 to 25 per cent took place on May 22, and these prices were holding firm on Tuesday. This advance does not include the advances in cotton that have taken place since then.

SWITCHBOARDS.—There is a steadily improving market in switchboards and instruments. Up to about two weeks ago the inquiries and orders from industrial plants seemed to predominate, but recently the balance has switched to central-station requirements. One prominent manufacturer reports more proposition work for switchboards than at any previous time.

FEEDER REGULATORS.—Interest in feeder regulators, up to a month or so ago quite dead, continues to improve, in keeping with the opening up of central-station activities.

FLEXIBLE ARMORED CONDUCTORS.—An increase in price of $3 per 1000 ft. has been reported this week. The demand is still heavy, and no relief has been afforded in manufacturing capacity.

TRANSFORMERS.—New York stocks of distributing-pipe transformers up to 10 kva. have been reported moving especially well. One reason given for the demand for this capacity has been the increasing application of appliances and labor-saving devices in the homes. The overloading of transformers due to this cause has required attention,

as complaints have come to central stations on account of poor operation of appliances. These have been traced back, according to one transformer manufacturer, to the addition of load without regard to transformer capacity.

SOCKETS.—Push sockets are reported up 3 cents each.

WASHING MACHINES.—Business is reported especially active, and prices are firm. The last advance reported was for the product of one prominent manufacturer, which was from $140 to $150 a few weeks ago.

CHICAGO

Jobbers report that the volume of business in the general line appears to be well maintained. There are many inquiries, but for smaller quantities than last year. Buyers are slower also, placing orders after receiving quotations. Prices appear to be unsteady, with a general trend toward bullishness. However, the jobbers are selling on a closer margin than they have been for a long time because the jobbers at present see the necessity for "making a market."

The War Department, headquarters central department, office departmental signal offices, Chicago, offered for sale under date of May 22, 1919, a list of material covering about three typewritten pages. It comprises brass products and copper products, including wire, insulating materials, fabric and wooden pieces. It is desired to close sales on this material by June 10. F. C. Ryan, inspection director, is in charge.

The general news which affects the trade is optimistic. Officials of the Illinois Central Railroad have agreed with the Chicago Commission on Railway Terminals and a subcommittee of the City Council committee on railway terminals for a fifteen-year electrification provision being written into the proposed ordinance for the improvement and electrification of the Illinois Central Railroad within Chicago.

Building permits for the week ending May 24 totaled $2,075,000 and the work projected totaled $6,040,000. This is a considerable increase over any of the recent previous weeks. It is nearly all of residential character.

NON-METALLIC CONDUIT.—An advance of 20 per cent was made on May 22, the discount being changed from 70 per cent to 50 per cent.

DRY BATTERIES.—While a decline in price is expected, no definite news as to the amount of the drop is available. Purchases for stock are at a minimum on account of the expected decline.

COPPER WIRE.—A considerably better market has been experienced during the last week, the average base price on weatherproof and rubber-covered moving up to 19 cents, while one company is quoting 20 cents.

LINE HARDWARE.—A steady demand continues to be felt by virtually all the manufacturers in the Middle West.

FIXTURES.—The standard styles are showing activity on account of the home-building program which is well under way.

PORTABLE LAMPS.—Some manufacturers of silk shades are sixty days behind on delivery, and certain brass parts for portable lamps are unobtainable in retail stores of Chicago.

CONSTRUCTION TOOLS.—A consolidation of companies is expected in the line construction tool business.

ELECTRIC FURNACES.—While the demand dropped off sharply with the signing of the armistice, there apparently is some activity in this field again.

ELECTRIC CONTROLLERS.—Manufacturers of electric control who sell to motor manufacturers find business especially brisk. The majority of the demand is for direct-current control.

AUTOMOBILE ACCESSORIES.—In order to get in closer touch with the South a group of Chicago automobile accessory manufacturers are sending a representative to take up headquarters at Jacksonville and Atlanta. He will work among the jobbers and dealers of the Southeastern territory.

BOSTON

Business is active this week, and one of the larger jobbers reports earnings 10 per cent in excess of those of the corresponding period of 1918. The demand for electrical household supplies is heavy, and in some lines it is hard to maintain adequate stocks. Prices reflect upward tendencies, wire showing a 1-cent increase in some classes over the quotations of last week. Armored flexible conductor is up $3 per 1000 ft. Stocks are well maintained, and collections are very good. The trade is feeling more optimistic than a few weeks ago and anticipates rapid expansion of building after the signing of the peace treaty. Certain makes of vacuum cleaners are running short, despite the efforts of manufacturers to enlarge their plant facilities.

Labor conditions are somewhat disturbed. About fifty workers in the mechanical department of the Western Electric Company's Boston office struck Monday morning, relations between the company and the union organization apparently being the cause of disagreement. It is announced that 82 per cent of returning Massachusetts service men are taking up work with their former employers, and that not a single electrical house has so far declined to reinstate a former employee who has been in the war service. Building activities are held back somewhat by high labor costs, but a good deal of work is being done none the less.

WIRE.—Bare wire is quoted at 19 cents base, weatherproof at 20 cents and slow-burning at 20.5 cents. The two first named are 1 cent higher than about a week ago, and the third is ½ cent up. Contractors are buying a bit more freely. Stocks are improved over a few weeks ago.

FANS.—Retailers have begun to buy fairly well, considering the moderate weather. Jobbers' stocks are in good shaps for early demands, but mid-season possibilities depend a good deal upon the thermometer. A protracted hot wave would soon exhaust many local stocks.

AUTOMOBILE STARTING AND LIGHTING SETS.—Trade is exceedingly brisk, and stocks are in good shape despite the heavy demand. Distributers are buying pretty consistently, however, and deliveries are well maintained

MOTORS.—Small alternating-current motors around 1 hp. are a bit "shy" in availability this week. The demand is confined chiefly to fractional-horsepower motors and sizes up to and including 5 hp.

RADIATORS.—A few radiators are moving for the seaside and mountain cottage trade. Stocks are generally in excess of immediate needs, and some price cutting appears to be under way as a temporary measure to dispose of an abnormal surplus.

WASHING MACHINES.—These outfits are being sold almost by the carload in New England, owing largely to the acute shortage of domestic labor. Prices are steady and sales have almost reached an automatic basis.

VACUUM CLEANERS.—A heavy demand and a supply restricted in some makes by limitations of factory output are evident.

DRY BATTERIES AND FLASHLIGHTS.—A moderate trade is reported, with ample stocks. Recent price weakness seems likely to facilitate summer buying.

FIXTURES.—Stocks are large in jobbers' warehouses recently visited. A fair sale of fixtures is noted, the demand coming chiefly from renovation activities.

FLEXIBLE ARMORED CONDUCTOR.—Prices rose $3 per 1000 ft. within a week, late quotations being $65 for one-strip and $68 for two-strip.

CONDUIT.—An excellent supply is on hand as regards immediate market requirements, though in some cases a larger accumulation of smaller sizes would ease the jobber's mind.

ELECTRIC COAL LOADERS.—The demand has picked up wonderfully within the past two months. One Massachusetts manufacturer reports orders in excess of present capacity, and his stocks have practically disappeared. Prices reflect stiffer costs.

ATLANTA

Building and construction of all descriptions which started off slowly the first of the year has been gaining in its stride each month, and present indications point to a record-breaking year in the Southeast. The value of construction at Atlanta up to and including May equals the total value for the entire year of 1918. May building alone is ahead of any figures for the same month since 1912, which was the biggest construction year in Atlanta's history.

Jobbers and dealers report an increasing demand for schedule material from all quarters with a consequent firm price range. Electrical contractors are busy, and although the jobs on hand and under way do not assume the extensive proportions of last year, business is highly profitable. A number of jobbers are running well ahead of last year. Collections along the entire line from manufacturers to dealers and contractors are good.

FLEXIBLE STEEL CONDUIT.—The movement shows a decided decrease. Prices hold remarkably firm and shipments from factory on standard sizes are normal.

LAMP GUARDS.—The ordinary slump for this season of the year is offset by further economies put into effect by industrials on lamp protection, and sales are satisfactory.

FUSE PLUGS.—Following the demand for schedule material, the volume of transactions for this item is showing a steady increase. A few stocks are above par.

CONDUIT.—It is difficult to discover the reason for a slump in sales this week covering both the white and black rigid product. This is a temporary condition, however, and a substantial immediate demand is looked for. Southeastern stocks are well filled.

FIXTURES.—All types are moving fast. Jobbers are putting forth more effort, with a resulting increase in business. Inquiries and orders from the smaller towns are growing.

HEATING DEVICES.—The volume of transactions to date is running considerably above last year. With the exception of irons, prices remain firm. Stocks reached a normal condition.

PORTABLES.—Sales at this time are better than the corresponding period last year. Standard colors in silk shades are moving well. The demand for floor lamps has fallen off.

LIGHTNING ARRESTERS.—Normal atmospheric conditions have stimulated sales, and transactions this week show a marked improvement over a semi-dormant market which has existed for the past month. Prices have declined gradually since the high mark of the previous season.

MOTORS.—Coincident with a brisk market one manufacturer has reduced prices 5 per cent on fractional-horsepower sizes. Factory facilities are much improved, and prompt deliveries on nearly all sizes are being made from local stocks.

SEATTLE—PORTLAND

Jobbers report for the week about the same volume of sales as for the past three weeks. The major portion of business is being done with shipyards and allied industrials. Utilities are buying very lightly and in most cases for maintenance work only. Prices are holding firm and collections still remain excellent.

Manufacturing agents, jobbers and retailers in Portland report that business is reasonably satisfactory, although, of course, it is not up to pre-war or war-time standards. There has been no movement of any particular line for several weeks, and price changes have been insignificant with the exception of a very material stiffening in the price of copper wire. Domestic appliances are moving along well, and house-wiring device sales are moving with increasing momentum owing to the general building conditions, which continue good. Many towns throughout Oregon report unusual activity in residence building. In Portland a large number of one-story and two-story brick and concrete buildings for store and factory purposes are under construction or are on the boards in architects' offices for immediate action. A large number of permits for residences are being taken out daily.

According to official figures, this year will produce the greatest crop in the history of the Northwest. Equally optimistic reports are received from fruit sections in Washington and Oregon. Northwest lumbermen report that commercial business has now resumed in good volume.

WASHING MACHINES.—A considerable number of these appliances were sold during the past week in smaller towns adjacent to Seattle, where sales campaigns of some importance are being conducted. In Seattle both jobbers and retailers report sales keeping up well. Stocks are in excellent shape and prices show no change.

VACUUM CLEANERS.—Sales in the outlying districts in the Puget Sound country are surprising the most optimistic. Steady prices and ready deliveries from local stocks have materially tended to increase sales. In Seattle and Tacoma nearly every jobber reports good business and exceptionally bright prospects.

FIXTURES.—Demand is growing with increase in residential building. Jobbers' stocks are in good shape, and shipments are coming through regularly. Prices show no change.

SAN FRANCISCO

Business in all branches of electrical activity is brisk. Money is more plentiful than ever before, and crops promise to be bountiful. Recent rumors of less drastic prohibition laws are encouraging to California grape and brewery interests, in which a great deal of money is invested.

LAMPS.—The expiration of important municipal contracts has occasioned a lively scramble for their renewal. Many contracts that were fairly stabilized in the past are being surprisingly shifted.

MOTORS.—Stocks and deliveries are good, and the demand for sizes from 1-hp. to 7½-hp. inclusive is very good and running fairly level with the demand of last year without the factor of drought which necessitated many purchases last season. There are not so many orders for large sizes as there were last season. Prices are fairly steady.

SCHEDULE MATERIAL.—The demand is gradually gathering volume, although the tendency is to buy for immediate requirements or prospective demands of the next two or three weeks.

HOUSE GOODS.—Stocks of bells, push-buttons, annunciators, etc., are fairly good in certain sizes, but on account of the sporadic demand the Coast houses are gradually eliminating the number of varieties and standardizing on fewer styles.

RUBBER-COVERED WIRE.—Local stocks are good. The demand is steady and the price has not changed during the past month. No. 14 single-braid solid is selling for approximately $13 per 1000 ft. in car lots. The circular-mil sizes are rather quiet, but, contrary to what one might expect, better stocks are being carried on the Coast of these large sizes, and they are being increased.

POLES.—Prices have been very steady for a year and a half in spite of increased freight rates, increased cost of handling and other factors. Competition is very keen along the Coast, with its many forests and odd bits of timber land. The past quarter has witnessed a revival of former brisk pole conditions, for there are a number of jobs in sight requiring several thousand poles and many styles of insulators and pieces of pole-line hardware.

FLOODLAMPS.—Not only has the sudden cessation of war conditions and precautions cut down sales, but the abrupt nature of the change has left big Coast stocks, which show slight immediate prospect of sale.

RADIATORS.—The standard household radiator, portable style, is retailing for $10.50, but there is small demand for it. Dealers were left with large stocks on their hands because of the early spring. Comparatively few protection orders for next season have been placed.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+ 20% to list
Coil to 1000 ft.	List to 5%
	No. 12 Solid
Less than coil	+ 20% to list
Coil to 1000 ft.	List to 5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00 to $115.00
Coil to 1000 ft.	82.50 to 100.00
	No. 12 Solid
Less than coil	+20% to list
Coil to 1000 ft.	List to 5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 20%
Std. pkg.	23% to 36%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅞-in.—	$25.00	$18.00	$16.00
1-in.—	30.00	19.50	17.50

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
⅞-in.—	$33.00	$17.50	$16.25
1-in.—	36.00	19.00	17.25

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 6.1%	+1% to 8.1%
2500 to 5000 lb.	2% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$7.00 to $7.50
Discount	25%

CHICAGO

List price	$6.35 to $7.50
Discount	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.01–$35.18
Coil to 1000 ft.	25.94–29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00
Coil to 1000 ft.	21.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–33%	10%–24%
$10.00 to $50.00 list	30%–45%	20%–32%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $22.40
1/5 to std. pkg.	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$17.85–$24.15
1/5 to std. pkg.	14.70–21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
		5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg.	10.50–11.20	15.35–18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
		5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg.	11.20–16.00	22.40–32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20 to list
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	23%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 50%	25% to 40%
$2.00 to $10.00 list	30% to 50%	25% to 40%
$10.00 to $50.00 list	30% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.40–$0.41
No. 18, full spools	.35–.36

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.46 to $0.53
No. 18, full spools	.41 to .47

WIRE, RUBBER-COVERED, N. C

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	$18.18	18.18	$13.64
10	24.30	24.30	16.20
8	33.12	27.60	22.08
6	52.50	43.75	35.00

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$17.50	$9.50	$8.90
12	21.63	21.63	18.54
10	28.91	28.91	24.78
8	39.34	33.72	33.72
6	61.74	52.92	52.92

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$25.00–$29.25
25 to 50 lb	25.00–25.25
50 to 100 lb	24.00–23.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$23.75 to $24.50
25 to 50 lb	23.75 to 24.50
50 to 100 lb	23.75 to 24.50

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

White-Glass, Tipless Gas-Filled Lamp

A white-glass lamp which is highly diffusing has been developed by the Mazda interests—that is, the Edison and National Lamp Works of the General Electric Company, at Harrison, N. J., and Cleveland, Ohio, respectively, and the Westinghouse Lamp Works, 165 Broadway, New York City—but is not ready for distribution at the present time. It is designated as the "Mazda C-4" and is markedly different from any other lamps in that it has no tip and the bulb diffuses the light so completely that the filament is not visible to the eye. The lamp will be furnished in the 50-watt size with the PS-20 bulb, and the dimensions will be approximately the same as in the 40-watt and 50-watt B lamp. The average life rating will be 1000 hours. A soft mellow illumination is afforded whether the lamp is concealed or exposed to the eye.

Electrically Heated Oven for Drying Out Lamps

Electrically heated ovens which are especially designed for drying out incandescent lamp bulbs before they are exhausted have been brought out by the William H. Dalton Company, 4 Charlotte Street, Salem, Mass. The ovens operate on 110-volt circuits and have energy consumption of about 600 watts. A temperature of between 575 and 750 deg. Fahr. (300 and 400 deg C.) is obtained, the maker states.

Brass-Set Screw Connectors

Brass-set screw connectors in two styles—one with a dividing wall and for use with standard cable and the other with wire holes extending clear through and for solid and stranded ca-

SOME STYLES HAVE TWO SCREWS

bles—are now being manufactured by the H. B. Sherman Manufacturing Company of Battle Creek, Mich. They are made from solid brass rod and the screws are heavily galvanized, making them rust-proof and enabling the connectors to be used over again when removed from temporary work. The connectors are supplied with two or four screws in sizes for Nos. 12 and 14 to No. 0000 B. & S. gage stranded wire and in sizes for No. 12 to 0000 and No. 8 to 0000 B. & S. gage solid and stranded cables.

Compact Portable Electric Drill

Compactness, strength and durability are obtained in the $\frac{9}{16}$-in. (14-mm.) size drill recently added to the line of portable electric drills made by the Black & Decker Manufacturing Company, 105 South Calvert Street, Baltimore, Md., through the attachment of the No. 1 Morse taper socket. This is in the form of a separable sleeve secured to the drill spindle by a large knurled nut. By unscrewing this nut

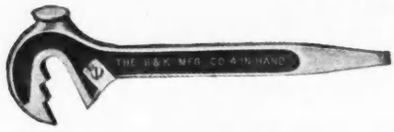
AIR-COOLED MOTOR FURNISHES POWER FOR DRILL

the entire taper socket is easily removed from the spindle. The drill shank, which protrudes slightly beyond the socket's end, is freed from the latter by a slight tap. This drill has a capacity of 0 in. to $\frac{9}{16}$ in. (14 mm.) in steel and is said to drill a $\frac{9}{16}$-in. (14-mm.) hole through machine steel at a rate of $1\frac{1}{2}$ in. (38 mm.) a minute without overloading the motor. It is also stated that a pressure as high as 500 lb. (226 kg.) has been applied without stalling the drill.

In its construction this drill resembles the other sizes made by this company. Gears are grease-packed in a separate compartment, while the drill spindle runs in a long bronze bushing and against a ball thrust bearing. The electric motor is an air-cooled type. Easy control is afforded by a pistol grip and a trigger switch. The weight is 21 lb. (9 kg.). An interchangeable spade handle and breast plate, 15 ft. (4.5 m.) of duplex cable, separable attachment plug and detachable side handle are supplied with the drill.

Combination Wrench, Hammer, Screwdriver and Scraper

The weight of the tools usually carried by electrical workers can be reduced by 3 lb. (1.3 kg.) through the use of the "Four-in-one" terminal wrench



WEIGHS ONE AND A QUARTER POUNDS

recently brought out by the B. & K. Manufacturing Company of New Britain, Conn., for installing its bracket and pole-line hardware. It combines a wrench, hammer, screwdriver and wire scraper and is made from high carbon steel, drop-forged, correctly balanced, finished and tempered.

The wrench jaws are fitted to take $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$-in. (9.5, 12.7 and 15.8-mm.) standard U. S. nuts. By using the head of the wrench as a handle a screwdriver is obtained. The hammer portion of the tool is sufficient to handle the average lighting installation, and the scraper can be used in cleaning conductors before they are made up. The length of the wrench is 10 in. (25 cm.) and its weight is $1\frac{1}{4}$ lb. (0.5 kg.).

Combined Lamp and Smoking Set

With a French "seventy-five" shell as its base and a reflecting shade shaped like a trench helmet, an adjustable electric lamp is being marketed by Snead & Company, Flatiron Building, New York City. The shell is cut into four sections which form a smoking set to hold cigars, cigarettes, tobacco, ashes and matches. Each part fits and locks with the others by a simple turn. Both smoking set and lamp can be used at the same time. The sectional construction affords a number of different heights since one, two or three parts may be removed and the lamp still used.

The shell is polished and lacquered to prevent tarnishing. The finish of the shade is brushed brass, and its interior is provided with an efficient reflecting surface. The bulb is controlled by a push-button switch in the socket. The assembled lamp stands 19 in. (48 cm.) high, the diameter of the base is $6\frac{1}{2}$ in. (16.5 cm.) and the helmet shade is $10\frac{1}{2}$ in. (26.6 cm.) in diam-

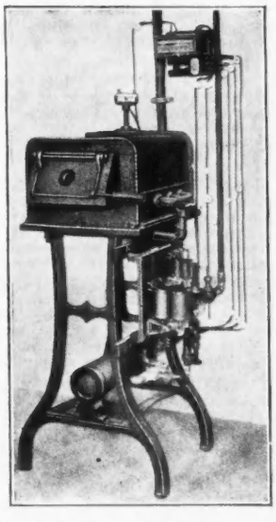
eter. A 6-ft. (1.8-m.) length of insulated cable with a two-piece screw or plug attachment is furnished with the lamp, which can also be furnished with a decorated parchment shade

Automatic Temperature Control for Gas Furnaces

For automatically controlling the temperature of gas furnaces the Brown Instrument Company of Philadelphia has developed an automatic temperature-control pyrometer. This instrument is similar to the Brown high-resistance pyrometer, except that the pointer is depressed upon the contact-making devices at intervals of every ten seconds. No current passes through the pointer itself, the circuit being completed by the upper platinum-tipped contact touching the lower one. The contact-making device is adjustable throughout the scale range of the instrument, and an index pointer shows the point at which the temperature is being controlled. The space between the two contacts on the high and low side, separated by insulating material, is equivalent to 1 per cent of the scale range. Control of the temperature of the furnace is therefore possible within 1 per cent of the total scale range. If a suppressed scale is used, a control twice as close can be obtained than where the first scale is used.

The energy for operating the relay which in turn operates the valve is very small, being about 1/10 amp. A small alternating-current or direct-current motor for 110 volts is employed to depress the pointer at the regular intervals and can be used on 220-volt circuits by using a resistance in series with it.

The illustration shows a gas-oven

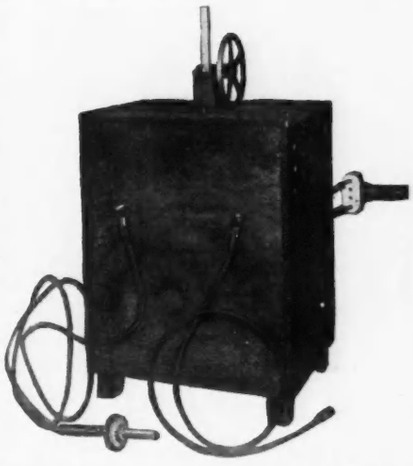


ALSO APPLICABLE TO STEAM, OIL OR ELECTRIC FURNACES

furnace with one of these automatic-control instruments and the solenoid-operated relay and valve. A thermo-couple of base metal or platinum rhodium is installed in the furnace and actuates the pyrometer on the wall. This control is also applicable to steam or oil, and by the use of a switch it may be employed with electric furnaces.

Alternating-Current Electric Welder

The important feature of the Zeus electric welder pointed out by the Gibbs Instrument Company of Detroit, Mich., its maker, is its adaptability to overhead welding and cast-iron welding, both of these classes of welding having heretofore given considerable trouble with arc-welding equipment. Instead of a motor-generator set with the disadvantages of bulk and moving parts, a transformer without any moving parts is used. It is said that this transformer consumes from 20 to 40 per cent less energy than the motor-generator type. Another feature of the



BUILT IN UNITS SO THAT ADDITIONAL CAPACITY MAY BE EASILY ADDED.

welder is said to be its arrangement for regulation. It is not necessary in any way, the maker points out, to change the connections in regulating the arc. A wheel extending through the top of the case raises and lowers the secondary and provides for the current regulation necessary for different sizes of electrodes. The inherent reactance of the welder is declared to stabilize the arc for different arc lengths automatically.

The welder is comparatively small and is portable. It is built on a unit system whereby a 150-amp. machine may be installed, and should the work become heavier, a duplicate may be connected in parallel with the original machine.

Light-Weight Safety Mine Searchlight

A shaft of light can be projected over 500 ft. (152 m.) with the smoke-proof, gas-proof and waterproof mine-type hand electric searchlight recently developed by the Grether Fire Equipment Company, Dayton, Ohio. It is constructed throughout of aluminum and is practically indestructible. No tools are required for its operation, and it is provided with a safety circuit-break attachment. An "Edison" non-spillable two-cell alkaline storage battery having a rated capacity of 125 amp.-hr. is employed.

SMOKE, GAS AND WATER PROOF

The normal charge and discharge rate is 3.75 amp. Two styles of reflectors are supplied—one a silver-plated spotlight type and the other an aluminum-faced "no-glare" type. The searchlight is furnished complete with a leather carrying shoulder strap.

NOTES ON RECENT APPLIANCES

Siren Fire Alarm

The Interstate Machine Products Company, Rochester, N. Y., is making a motor-driven fire-alarm siren.

Blower with Many Uses

A combination blower which can be used as a heater, an air washer, a fan, a hair drier or a deodorizer has been placed on the market by the Claxo Company of Iowa City, Iowa.

Stucco-Applying Machine

Portable motor-driven machines which project stucco onto walls by centrifugal force are being made by the Hodges Stucco Machine Company, Union Central Life Insurance Building, Cincinnati, Ohio.

Pipe Threader with Separate Die Heads

The Borden Company of Warren, Ohio, is manufacturing Beaver Junior pipe threader No. 3, which is equipped with separate die-head units for pipes from ⅛ in. to 1 in. (3 mm. to 25 mm.) in diameter.

Heavy-Duty Disconnecting Switch

Disconnecting switches for isolating oil switches at the generating end of switching stations and for line sectionalizing have been developed by the Maxwell Engineering & Manufacturing Company, 61 Broadway, New York City.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm in Belgium (No. 29,325) wishes to purchase electrical automatic pumps. Correspondence may be in English.

A company in India (No. 29,414) desires to be placed in communication with firms, with a view to securing representation for the sale of electrical supplies.

The president of a firm in this country (No. 29,335), who is about to make a trip to Cuba and South and Central America, desires to secure agencies for the sale of electrical supplies, motors and generators.

The purchase and agency for the sale of electrical material are desired by a firm in Spain (No. 29,380). Quotations should be given f.o.b. New York. Payment, cash against documents at port of shipment. Correspondence should be in Spanish.

The purchase of small electrical material, such as sockets, rings, insulators, keys and switches, is desired by a firm in Spain (No. 29,382). Terms, cash against shipping documents at destination. Correspondence should be in Spanish.

A firm in Spain (No. 29,346) desires to secure agencies on a commission basis for the sale of electrical material and apparatus, such as lamps, motors, fans, plates, stoves and water-heating apparatus. Correspondence should be in Spanish.

A firm in Belgium (No. 29,304), having a representative in this country, desires to purchase and secure agencies for the sale of electric motors of 5 to 8, 10, 12, 15, 20, 22, 24, 30, and 50 hp., three-phase, 220 volts. Correspondence may be in English.

Electric heating and cooking appliances, electric light fittings and electric wire are required by a firm in New Zealand (No. 29,369). Agencies will also be accepted. Quotations should be given f.o.b. port of shipment. Terms, cash against documents under New York letter of credit.

Agencies are desired by the head of a firm in New Zealand (No. 29,420), who is now in America, for the sale of electric trucks of ½-ton to 7-ton capacity, and electrical machinery and supplies, including motors, generators, batteries, wire and cable.

The French agent of an American company (No. 29,412) is in the market for a number of mechanical shovels driven by electric motor, for use in mines. The mine shaft is not higher than 7 ft. 2 in., and the equipment should be of corresponding size. Further details and sketch will be furnished by the company upon request. Terms cash.

The Société Française d'Action Economique, 1 rue des Italiens, Paris, France, which is represented here by Daniel T. Pierce, 149 Broadway, New York, reports that it has inquiries from French firms who desire agencies in France for electrical supplies.

IMPORTS INTO COLOMBIA.—Imports of electrical goods into Barranquilla, Colombia, in 1917, amounted to $198,000 from the United States, $3,325 from the United Kingdom, $195 from France, and $3,980 from Spain, totaling $205,500.

FOREIGN TRADE OF SOUTH AFRICA.—Imports into the Union of South Africa for 1917 and 1918 respectively are: Electrical cable and wire, $261,000 and $441,000; electrical fittings and posts, $1,006,000 and $1,394,000; electrical machinery and parts, $731,000 and $615,000.

ELECTRICAL TRADE WITH BRITISH COLUMBIA.—Of the merchandise imported into the Province of British Columbia, Canada, that passing through Vancouver and Victoria comprised approximately 85 per cent in 1918. Electrical apparatus, motors, etc., amounted to $197,844 at Vancouver and $38,728 through Victoria. Electrical fittings to the amount of $18,531 were exported to the United States in 1917 from Vancouver, Victoria, Prince Rupert and Fernie, with no figures available for 1918.

Western Electric Sales Changes

The following changes in the sales personnel of the Western Electric Company will take effect June 1:

J. ALPHONSO PIZZINI, for a number of years sales manager at the New York office, has been appointed assistant manager at the same place. Mr. Pizzini went to the Western Electric Company in 1901 as a member of the supply sales organization at New York and became sales manager in 1907 and manager of the domestic sales department in 1911.

W. J. DRURY, until recently manager of the Cleveland house, has been appointed sales manager at New York. Mr. Drury joined the company in 1904, in the educational course, and became a member of the engineering department at the Hawthorne Works in 1906. Several years later he joined the sales organization and became telephone sales manager at St. Louis in 1911. In 1912 he joined the specialty sales organization in New York and was later in the same year transferred to Dallas to become sales manager there. In 1917 he became manager at the Cleveland house.

ARTHUR M. COLLINS, who becomes manager of the Cleveland office, became connected with the company in the engineering department at Chicago in 1906. He became sales manager of the Indianapolis house in 1910, returning to Chicago in 1914, where he remained until he became sales manager of the Detroit office in 1917.

J. A. PIZZINI

A. R. MAYNARD, until recently connected with the Chicago sales department, succeeds Mr. Collins as manager of the Detroit office.

WALTER TREAT WALKER has been appointed manager of the Buffalo office. Mr. Walker first joined the Western Electric in 1906 and in 1909 took charge of power apparatus sales in the New York office. During the war he served as first lieutenant in the Signal Corps, U. S. A. On his discharge from the service he was appointed manager of the Newark office, in February, 1919.

GREGORY BROWN has been appointed manager of the Newark house to succeed Mr. Walker. Mr. Brown joined the company in 1905 as a member of the engineering department. He jointed the general telephone sales organization in 1911 and became acting assistant manager of the Cincinnati office in 1914. In 1916 he went to the New York house as supply specialist.

J. M. SHINKLE, formerly connected with the engineering department, has been appointed assistant manager of the government department, with headquarters at New York.

NEW JOBBING HOUSE AT SOUTH BEND.—The Interstate Electrical Supply Company is the name of a new electrical jobbing house which has been established at South Bend, Ind., with an authorized capitalization of $100,000. Many of the local electrical contractor-dealers are taking stock in the institution along with other local interests.

TRADING WITH THE FAR EAST.—A comprehensive volume dealing with the above subject is being distributed by the Irving National Bank of New York City.

1920 FOREIGN TRADE CONVENTION.—The seventh national foreign trade convention will be held in San Francisco, Cal., on May 12-15, 1920. It will be the first of these important conventions to be held on the Pacific Coast, previous conventions having been held at Washington, D. C., New Orleans, St. Louis, Pittsburgh, Cincinnati and Chicago. In deciding on San Francisco for the convention city, the National Foreign Trade Council was influenced by the growing importance of the Pacific Coast in the foreign commerce of the country and by the enthusiastic support which the Far West has given all previous foreign trade gatherings.

INCREASED MANUFACTURE OF ELECTRIC HEATERS IN SWEDEN—The use of electricity for heating purposes is comparatively new, but since the enormous water power in Sweden and Norway has been increasingly utilized, and especially because of the acute shortage of fuel during the war, electric heating has become more and more extensive in Scandinavia. Elektriska A. B. Volta was organized in Stockholm in 1915, for the manufacture of electric heating apparatus. In the beginning this factory employed forty men, but at the end of 1917 the number had increased to 500. Extensions are now being made which are expected to be finished in the fall of 1919, when the number of employees will be about 1200. The factory makes all kinds of heating apparatus for cooking, ironing, etc., and all kinds of lamps and heating materials.

THE STANDARD ELECTRIC & ELEVATOR COMPANY, INC., Baltimore, Md., has opened a New York office at 280 Broadway, in charge of C. A. Yarrington, formerly sales manager of the company.

THE H. C. TAFEL ELECTRIC COMPANY, Louisville, Ky., has filed amended articles of incorporation, changing the name to the Tafel Electric Company and increasing the capital stock from $75,000 to $125,000.

ROLAND B. PAGE has recently been appointed Eastern district manager for the Lea-Courtenay Company, manufacturer of centrifugal pumping machinery. His new offices are at 810 Broad Exchange Building, Boston.

LIEUT. JOHN K. SELLECK, who has recently been discharged from the United States Army, has returned to the employ of the National X-Ray Reflector Company, Chicago, and has been made advertising manager.

E. C. CAMP has been elected assistant treasurer and assistant to the president of the Solar Metal Products Company, Inc., Columbus, Ohio. He continues his work as sales manager in charge of sales and advertising.

L. G. LE BOURVEAU has retired as secretary and sales manager of the American Electric Company, Chicago, and has moved South to engage in the automobile accessory business at Atlanta, Ga., and Jacksonville, Fla.

W. H. WILLIAMS and THOMAS E. BEASLEY, formerly representing the Electric Controller & Manufacturing Company, in the Chicago district, have established themselves as electrical sales engineers at 343 South Dearborn street, Chicago.

THE FRIGIDAIRE CORPORATION, Detroit, Mich., has put out its first number of a publication on the utility of frigeration in homes, stores, clubs, hotels, etc. It is merely further evidence of automatic frigeration in small and large capacities.

A. E. HITCHNER has been appointed manager of the mining section of the industrial sales department of the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburgh, Pa. Mr. Hitchner is a graduate of Rutgers College, class of 1904. He served a two-year apprenticeship with the Baldwin Locomotive Works and spent three years with the Link Belt Company on construction work before joining the Westinghouse sales organization as industrial salesman in its Philadelphia office in 1909. In 1912 he was sent as sales representative to the anthracite coal field and placed in charge of the Wilkes-Barre office. In his new position Mr. Hitchner will handle the sale of all apparatus made by the Westinghouse company for use in the mining industry.

THE WALTER A. ZELNICKER SUPPLY COMPANY, St. Louis, has just appointed F. X. Meehan as advertising manager.

THE TRIUMPH ICE MACHINE COMPANY announces that T. W. Kloman is located at 30 Church Street, New York City, in charge of the New York office.

THE HOOVER SUCTION SWEEPER COMPANY'S New York salesroom is now on the eighth floor of the Bush Terminal Sales Building, West Forty-second Street.

W. N. MATTHEWS & BROTHER, INC., have discontinued their Washington office and have moved their New York office to 50 Church Street. Warren M. Heim is Eastern District manager, in charge of the New York office.

THE NATIONAL METAL MOLDING COMPANY, Pittsburgh, manufactured the conduit, sheraduct, used throughout the new Hotel Pennsylvania, the electrical work of which was described in the ELECTRICAL WORLD for May 10.

M. H. JONES, who has been connected with the Westinghouse Electric & Manufacturing Company for the past fifteen years as assistant to the manager of the Philadelphia District, has resigned his position with that company to become sales manager of the Standard Electric & Elevator Company of Baltimore.

PAUL W. KOCH & COMPANY announce that Pacific Coast offices have been opened at 114 San Fernando Building, Los Angeles, 324 Rialto Building, San Francisco, and 342 Sherlock Building, Portland, Ore. These offices will handle the company s business on the "Jiffy" adjustable cutter, "Jiffy" speed and punch and other "Jiffy" labor-saving tools.

JOHN E. MUHLFELD has associated with him several other engineers and has formed the Railway and Industrial Engineers, Inc., with offices at 25 Broad Street, New York City, to act as consulting and advisory engineers between the bankers, railroad and industrial corporations. For the last three and one-half years he has been president of the Pulverized Fuel Equipment Corporation, but he has resigned as president of this corporation to devote his entire time to engineering work. Mr. Muhlfeld retains his interests in and remains a director of the Pulverized Fuel Equipment Corporation.

THE HENDERSON-MOCKENHAUPT Company, Chicago, has been organized to act as sales representative for manufacturers of electric material. A. F. Henderson, president of the company, was formerly secretary and general sales manager of the Electrical Material Company. B. J. Mockenhaupt, secretary and treasurer of the new company, was formerly vice-president of the W. P. Crockett Company. Among the lines being handled by the Henderson-Mockenhaupt Company are those of the Independent Lamp & Wire Company, Electric Railway Equipment Company, National Enameling & Manufacturing Company and Rattan Manufacturing Company. A. C. Perrin, formerly railway and mine specialist for the Electrical Material Company, is also associated with the Henderson-Mockenhaupt Company.

THE WHITE LILY MANUFACTURING COMPANY, Davenport, Ill., has begun work on its $150,000 plant, according to Sam T. White, president of the washing-machine concern. The addition to the present plant will comprise seven buildings 30 ft. by 225 ft. in dimensions, using the sawtooth type of factory construction; a factory building 225 ft. by 200 ft. with floor space of 45,000 ft., and a warehouse 30 ft. by 225 ft. Unfilled orders totaling $50,000 which the Davenport concern could not turn out with the old plant were the cause of beginning this big addition immediately. Last year the White Lily Manufacturing Company did a gross business of $1,000,000. This year the demand for electric washing machines was so large that the big plant has been literally swamped with orders. One hundred and fifty men are now employed at the washing-machine factory. This number is being increased as fast as skilled labor can be secured. President Sam T. White has recently returned from a five weeks' business trip through the East. While there he placed the White Lily output in eight stores of the New York Edison Company and made contracts with large firms to handle the Davenport product in the following cities: Cleveland, Akron, Buffalo, Boston, Philadelphia, Baltimore, Wilmington, Del.; Lowell, Mass., and Manchester, N. H.

Trade Publications

IRONER.—Dealers' catalog No. 40 has been prepared by the American Ironing Machine Company, 166 North Michigan Avenue, Chicago, to cover its Simplex ironing machines.

IRONING BOARDS.—"Standpat" ironing boards for laundries are illustrated and described in a circular from the American Ironing Machine Company, 166 North Michigan Avenue, Chicago.

ASH DISPOSAL.—The American Steam Conveyor Corporation of 326 West Madison Street, Chicago, has just issued a booklet on the ash-handling question called "Reducing Ash Disposal Costs."

WASHING MACHINE.—The "White Way" twin-tub washer is shown and described in a folder that the White Lily Manufacturing Company of Davenport, Iowa, has recently issued.

STEAM TURBINES.—Type 6 steam turbines have been made the subject of catalog No. 256, a well-prepared booklet, which the B. F. Sturtevant Company of Hyde Park, Boston, has issued.

PORTABLE ELECTRIC GRINDERS.—The Van Dorn Electric Tool Company of Cleveland, Ohio, illustrates some uses of its portable electric grinder in a descriptive folder recently distributed.

FANS.—A small catalog of its electric fans for the 1919 season has been printed by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City.

FANS.—The Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City, are distributing a four-color folder illustrating a number of their electric fans.

MINERS' HAND LAMP.—The Grether mine safety-type electric searchlight is the subject of a leaflet issued by the Mine Safety Appliance Company, 908 Chamber of Commerce Building, Pittsburgh, Pa.

VACUUM CLEANER.—The Federal electric vacuum cleaner, model 19, is described in detail by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, in a loose-leaf sheet, dated March 1, 1919.

WASHING MACHINES.—The White Lily Manufacturing Company of Davenport, Iowa, describes its "De Luxe Junior" revolving bench washer and swinging wringer washer in a folder of recent preparation.

SEMI-INDIRECT LIGHTING FIXTURES.—The schedule R published by the Wheeler Reflector Company, 156 Pearl Street, Boston, contains descriptive material on "Mellowlight" semi-indirect lighting fixtures.

DRYING CABINETS.—Drying cabinets and electrically driven ventilating fans for laundries are the subject of bulletin No. 39-0 issued by the American Ironing Machine Company, 166 North Michigan Avenue, Chicago.

IRONER.—Operating the Simplex ironing machine is explained in an illustrated booklet of twenty-four pages that has been published by the American Ironing Machine Company of 166 North Michigan Avenue, Chicago.

TEMPERATURE CONTROL INSTRUMENTS.—The Taylor Instrument Companies of Rochester, N. Y., have issued a general industrial catalog of instruments, containing 422 pages of interesting temperature information.

IRONER.—"Clean Linen in Abundance" is the title of an interesting booklet prepared by the American Ironing Machine Company, 166 North Michigan Avenue, Chicago, to tell some of the advantages of its Simplex ironing machines.

IRONER.—Directions for wiring, connecting and testing the electrically heated Simplex ironing machine made by the American Ironing Machine Company, 166 North Michigan Avenue, Chicago, are contained in a recently distributed folder.

HEATING APPLIANCES.—The G-E Division, Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, is sending to dealers an attractive folder explaining in detail its plans for national publicity for G-E electrically heated household appliances.

New Incorporations

THE SOUTH HOUSTON (TEX.) ELECTRIC COMPANY has been incorporated with a capital stock of $2,500 by I. W. Clark, F. I. Churchill and W. T. Hicks.

THE BELZO ELECTRIC MOTOR COMPANY of New York, N. Y., has been incorporated with a capital stock of $250,000 by H. C. McCullum, L. F. Schwartz, Jr., and H. C. Field, 34 Nassau Street, New York City.

THE LYONS IGNITION COMPANY of Paterson, N. J., has been incorporated with a capital stock of $200,000 to manufacture spark plugs and ignition equipment. The incorporators are: Winfred T. Chisholm, Lemuel Skidmore, Jr., and Walter H. Griffin.

THE UNION ELECTRIC & MACHINE COMPANY of Charlestown, W. Va., has been chartered by Arthur Brounlow and associates. The company is capitalized at $25,000 and proposes to manufacture electrically operated machinery and general electrical specialties.

THE UNITED ELECTRIC COMPANY of Dubuque, Iowa, has been chartered with a capital stock of $15,000 to do general electrical contracting business and to deal in eletcrical supplies. The directors are: Joseph Lowe, president and treasurer, and Clarence J. Willging, secretary.

THE BELL-SCHOENLEBER MANUFACTURING COMPANY of New York, N. Y., has been incorporated by T. H. Bell, J. G. Schoenleber and W. A. Ritchie, 201 West Fifty-third Street. The company is capitalized at $100,000 and proposes to manufacture electrical specialties.

THE GRAVENITE PRODUCTS, LTD., of Toronto, Ont., has been incorporated by William S. Morlock, 85 Bay Street; Reginald H. Parmenter, 93 Dunvegan Road, Sydney E. Wedd and others. The company is capitalized at $240,000, and proposes to manufatcure machinery, electrical devices, etc.

THE KAWAKITA ELECTRIC CORPORATION of New York, N. Y., has been incorporated by E. D. Spunt, N. Osugi, 15 Park Row, and I. Opas, 526 West 211th Street, New York City. The company is capitalized at $200,000 and proposes to manufacture electric devices, motor, meters, etc.

THE R. & P. MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $30,000 by Alvin H. Rosenbaum, Sidney L. H. Phillips, F. B. Klose, 100 Forty-fourth Street, Brooklyn. The company proposes to manufacture and deal in gas and electric fixtures, etc.

THE PITTSBURGH ELECTRIC FURNACE CORPORATION of Pittsburgh, Pa., has been chartered with a capital stock of $5,000 by Frank Wright, 217 South Mathilda Street, East End; W. G. Kifer, Penn Street, and H. F. Alter, 1527 Brownsville Road. The company proposes to manufacture electric furnaces.

THE PENOBSCOT LIGHT & POWER COMPANY of Lincoln, Me., has been incorporated with a capital stock of $10,000 to supply electricity for lamps and motors in the towns of Winn and Mattawamkeag. The officers are: Fred D. Sherrard, president; B. Frank Wyman, treasurer, and Robert Carll, clerk, all of Winn.

THE BAETZ BROTHERS SPECIALTY COMPANY of Kitchener, Ont., has been incorporated by Jacob H. Baetz, Walter J. Fleischauer, of Kitchener; William H. Beney, 121 Lee Avenue, Toronto, and others. The company is capitalized at $40,000 and proposes to manufacture electrical apparatus, machinery, instruments, etc.

THE TERREBONNE (QUE.) ELECTRIC POWER & STEEL COMPANY has been incorporated with a capital stock of $2,500,000 to manufacture machinery, implements and kindred articles in which iron or steel is used. The incorporators are: Sydney W. Waters, Cecil V Rogers, Joseph T. Murray and others, all of Montreal.

New England States

NASHUA, N. H. — Extensive improvements are contemplated by the Nashua Manufacturing Company at the Jackson mills, involving an expenditure of about $2,500,000. The proposed work will include the erection of a new mill and a new water-power plant at the lower dam, increasing the power capacity from 1100 hp. to 1900 hp. Lockwood, Greene & Company of Boston, Mass., are engineers.

MONTPELIER, VT.—The City Council has authorized the installation of electric street lamps from the present terminus to the town line at Wrightsville. It is estimated that thirty-one lamps will be required to complete the circuit. The street-lighting service is furnished by the Montpelier & Barre Light & Power Company.

LEOMINSTER, MASS.—The installation of a new street-lighting system in the business district is under consideration.

BRIDGEPORT, CONN.—The city has appropriated $150,600 to erect a garage on Washington Avenue. J. A. McElroy is city engineer.

STAMFORD, CONN.—The Electric Specialty Company is contemplating an extension to its works, 41 ft. by 100 ft., two stories, to be equipped with electrically driven machinery.

WATERBURY, CONN.—A permit has been granted to Benedict & Burnham, branch of the American Brass Company, for the construction of a power house to cost about $50,000.

Middle Atlantic States

MONTAUK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 11 for construction of power house at Montauk, to cost about $4000. A deposit of $10 will be required for plans.

NEW YORK, N. Y.—The New York Edison Company is planning to erect a transformer station at 421 and 423 East Sixth Street.

NEW YORK, N. Y.—Plans have been prepared by E. J. Moeller, architect, 103 Park Avenue, for the erection of a ten-story building for the Hudson Motor Company, 1842 Broadway, on Sixty-second Street and Amsterdam Avenue, to cost about $550,000.

NIAGARA FALLS, N. Y.—Plans have been completed by the Niagara Falls Power Company for the erection of an aërial high-tension transmission line from the hydraulic power plant in the lower milling district, along the canal and river and up the river bank along Adams Avenue to the foot of Sugar Street, and across to the new transformer station now being erected between Sugar and Union Streets. The plans provide for an ultimate load of 400,000 hp., to be transmitted at 80,000 volts. The company has been granted permission to cross the city streets.

SALAMANCA, N. Y.—The Council contemplates calling an election to vote on the proposal to issue $15,000 bonds for the installation of new fire alarm and telegraph systems.

SOLVAY, N. Y.—Work has been suspended on the construction of the new electric power plant of the New York Central Railroad Company at Solvay. The cost of the proposed plant is estimated at about $500,000, and it has been designed to furnish energy for the company in this district, including shop, buildings, etc. Construction work, it is said, will be resumed upon return of the road to the company by the government.

SYRACUSE, N. Y.—The New York State Railways is contemplating improvements to its transmission and trolley lines, track repairs and paving, involving an expenditure of about $200,000.

FREEHOLD, N. J.—Bids will be received by the Board of Supervisors of Monmouth County until June 4 for construction of hospital building, including power house and laundry, water supply system and sewerage disposal system near Allenwood, Wall Township. W. M. Bergen is director.

NEWARK, N. J.—Bids will be received by the board of education of the County of Essex, Newark, until June 17 for construction of the Seymour Vocational School, to be erected on Sussex Avenue, between First and Second Streets, including general construction work, heating, ventilating and power apparatus, engines and generators, electric work, plumbing and vacuum cleaner. Blanks and other information may be obtained at the office of John H. and Wilson C. Ely, architects, Firemen's Building, Newark. R. D. Argue is secretary.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BEAVER FALLS, PA.—The City Council has accepted plans submitted by the Beaver County Light Company of New Brighton for the installation of a new street-lighting system for the city.

BLAIRSVILLE, PA.—Plans are being prepared by Crooks & Cooley, architects, Jones Law Building, Pittsburgh, for construction of hospital and group of buildings near Blairsville, consisting of administration building, power house, laundry, four ward buildings, sewage disposal plant, reservoir, auditorium, nurses' home and morgue. The cost is estimated at about $2,000,000. G. S. Idell, 34 South Sixteenth Street, Philadelphia, Pa., is the consulting architect.

CAMBRIA, PA. — Extensive improvements to its Cambria plant, calling for an expenditure of about $14,000,000, are under consideration by the Midvale Steel & Ordnance Company. Several additions are contemplated, including the erection of a new machine shop and an axle plant.

COATESVILLE, PA.—The Chester Valley Electric Company, it is reported, is planning to erect a new transmission line from Coatesville to Downingtown, to cost about $80,000.

FARRELL, PA.—The City Council has engaged H. Whitford Jones, consulting engineer, of Cleveland, Ohio, to prepare plans for the installation of a new street-lighting system, including ornamental lamps in the business district. The cost is estimated at $25,000. The Shenango Valley Electric Light Company furnishes street-lighting service in Farrell.

MAUCH CHUNK, PA.—The Carbon Transit Company, it is reported, is contemplating the purchase of new equipment for its power plant and also improvements to its power line.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has been granted a permit to erect an addition, 22 ft. by 29 ft., to its power plant at 963 Beach Street.

PITTSBURGH, PA.—Work has been started on the construction of a 60,000-kw. electric generating plant at Cheswick for the Duquesne Light Company. It is planned eventually to install another unit of 60,000 kw., increasing the output to 120,000 kw. The cost of the initial unit is estimated at between $10,000,000 and $15,000,000.

SOUTH BROWNSVILLE, PA.—The West Penn Power Company of Pittsburgh has submitted to the Borough Council a proposal to install a new street-lighting system. It is proposed to replace the lamps now in use with six 600-cp., thirty-nine 400-cp., forty-two 250-cp. and fifty-four 80-cp. lamps.

MONKTON, MD.—Contract has been awarded by the Monkton Roller Mills to E. H. Mosher, Munsey Building, Baltimore, for the construction of a 300-hp. hydroelectric plant, to cost about $30,000, in connection with flour mill. Otis E. McCoy, of Mount Washington, Md., is president.

SPARROWS, POINT, MD.—The Bethlehem Steel Corporation is contemplating further extensions to its local plant, involving an expenditure of between $25,000,000 and $40,000,000, consisting of new tin mills, a new hearth furnace and the adding of ten ships to the present ore fleet of the corporation. This will be in addition to the $50,000,000 improvements now under way.

WASHINGTON, D. C.—Bids will be received by the office of the chief of engineers, development branch, equipment section, until June 20 for development of a distant searchlight control and indicator.

North Central States

ALGONIAC, MICH.—Negotiations are under way between the City Council and the Detroit (Mich.) Edison Company for the purchase of the municipal electric plant. A special election will be held to vote on the proposal. If the sale is approved by the voters, the company will apply for a franchise to operate in the town, village and township.

MOUNT PLEASANT, MICH.—Plans have been prepared by the Transport Truck Company for construction of power plant, 40 ft. by 50 ft., and assembly plant, to cost about $80,000. J. J. Bachman of Flint is architect.

NEWTON FALLS, OHIO.—The Akron Maderite Tire & Rubber Company of Akron is planning to erect a plant in Newton Falls. The first unit will be 60 ft. by 240 ft., three stories. A power house will also be erected. N. A. Walcott of the Packard Electric Company is president.

OXFORD, OHIO.—Bids will be received by the trustees of Miami University, Oxford, until June 14 for an engine and generator, together with switchboard changes and wiring and piping connections, for the central heating and lighting plant of the Miami University. Plans and specifications are on file at the office of Walter G. Frantz, consulting engineer, Cincinnati, Ohio, and at the office of the president of Miami University, Oxford.

SPRINGFIELD, OHIO. — The Clark County Lumber Company is planning to erect a planing mill, to be equipped with electrically operated machinery.

ASHLAND, KY.—Bids, it is reported, will be received about June 10 by the Commissioner of the Water Works Department for construction of a 2,000,000-gal. filtration plant, electrically driven centrifugal pumps and necessary appurtenances. The cost is estimated at about $90,000.

FORT WAYNE, IND.—The Board of Public Works has authorized bids to be advertised for installing ornamental lamps on Crescent Avenue between State and Lane Avenues.

KOKOMO, IND.—Plans have been perfected by the Haynes Automobile Company for extensions to its local plant, including a power plant of 750 hp. A. G. Seiberling is general manager.

SOUTH BEND, IND.—The Union Electric Company has acquired the property formerly occupied by the Indian Engraving Company on South St. Joseph Street, on which it will erect a large building.

BAYFIELD, WIS.—The municipal electric plant was partially destroyed by fire recently, causing a loss of about $10,000.

BLACK RIVER FALLS, WIS.—Tentative plans have been adopted by the Council for improvements to the municipal hydroelectric power plant on Black River. The proposed work will cost about $25,000 and will include the installation of an additional waterwheel, vertical type, and a 400-kw. umbrella-type generator. Proposals, it is understood, will be asked for within the next two weeks.

MERRIMACK, WIS.,—The Merrimack Electric Light Company is contemplating the installation of an electric lighting system to supply electricity in Merrimack.

MILWAUKEE, WIS. — Bids, it is reported, have been received by the Robert A. Johnson Company for the erection of a new factory at Thirty-fourth and National Avenues, to cost with equipment about $750,000. The structure will be 190 ft. by 310 ft., six stories, with a separate power plant.

STOUGHTON, WIS. — The Stoughton Wagon Company is planning to install a 400-kw. steam-driven generating unit to replace a 150-kw. unit now in use. An extension is now being erected to the power house.

WATERLOO, WIS.—Bids, it is reported, are being asked by the Board of Public Works of Waterloo for the installation of a 100-kw. generator directly connected to a Corliss or uniflow type engine in the municipal electric light plant. W. J. Hugo of of Madison is consulting engineer.

FAIRMONT, MINN.—Plans are under consideration by the Water and Light Commission for extensions to the municipal electric light plant, to cost about $15,000.

HASTINGS, MINN.—Bids will be received by the State Board of Control, St. Paul, until Aug. 1, for construction of building, 45 ft. by 140 ft., and power house at the Hastings State Hospital, to cost about $125,000. C. H. Johnston, Capital Bank Building, St. Paul, is architect.

ROCHESTER, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until June 5 for construction of a dormitory for men employees, State Hospital, Rochester, including general contract heating and ventilating, plumbing and electrical work, and repairs to power house. Separate bids to be submitted. Copies of plans and specifications may be obtained at the office of the State Board of Control, Institution, and C. H. Johnson, architect, Capital Bank Bldg., St. Paul.

ST. JAMES, MINN.—Contract has been awarded to the Sterling Electric Company, 33 South Fifth St., Minneapolis, for the installation of an ornamental lighting system in St. James, to cost $19,700.

ST. PAUL, MINN.—An appropriation of $20,000 has been made by the Legislature for improvements to Itasca State Park, of which $2,000 will be expended for a new electric lighting plant. At present oil lamps are used.

ULEN, MINN.—The sale of the municipal electric light plant to J. F. Heiberg, owner of the electric plant at Heiberg, is under consideration by the Village Council. If favorable action is taken by the voters, Mr. Heiberg proposes to install a second generating unit in his plant, which is located on Wild Rice River, 3 miles from Twin Valley. The transmission line will be about 15 miles long. The plant now supplies electricity to Twin Valley and Gary. The proposed extension will supply electricity to Syre and to farmers along the line, as well as Ulen.

WELLS, MINN.—The construction of an electric power plant and distribution system and concrete reservoir, to cost about $40,000, is under consideration by the City Council. The C. L. Pillsbury Company, Metropolitan Building, Minneapolis, is engineer.

CEDAR RAPIDS, IOWA. — The Iowa Railway & Light Company is reported to be contemplating an extension to the Old Soldiers' Home.

CENTERVILLE, IOWA.—The Southern Iowa Utilities Company is contemplating the erection of an electric transmission line from Diagonal to Shannon City and Tingley, a distance of about 20 miles.

HUMBOLDT, IOWA — The Northern Iowa Gas & Electric Company is contemplating extending its electric transmission lines from Ruthven to Lost Island Park.

KEOKUK, IOWA.—The capital stock of the Keokuk Power Transmission Company has been increased from $200,000 to $800,000.

NEWTON, IOWA.—Plans have been prepared by Archer & Stevens, engineers, New England Building, Kansas City, Mo., for improvements to the municipal electric plant, to cost about $175,000.

DE WITT, MO.—The city of De Witt has voted to install an electric lighting service. Electricity will be secured from the plant at Carrollton.

KANSAS CITY, MO.—The City Council is considering the installation of a 1000 or more additional electric lamps in the outlying districts this year. An appropriation of $250,000 for street lighting is recommended by the Council, an increase of $30,000 over last year.

MEXICO, MO.—The Mexico Power Company is reported to have awarded a contract for the installation of a new generating unit, to cost about $40,000.

ST. LOUIS, MO.—Plans are being prepared by the Motor Garage & Realty Company, 46 Kingsbury Place, for the erection of a three-story building, 250 ft. by 250 ft., on the block bounded by Seventeenth, Eighteenth, Pine and Chestnut Streets, to cost about $300,000. N. W. Ewing is president.

MINOT, N. D.—A movement is on foot to establish a municipal electric plant in Minot. The Northern States Power Company is reported to have offered its plant to the city, the price to be determined by engineers selected by the city.

PEMBINA, N. D.—The Pembina Light & Power Company is planning to equip its plant for a twenty-four-hour service. Additional equipment, it is understood, will be purchased by the company.

MADISON, S. D.—Bonds to the amount of $100,000 have been authorized for the construction of a municipal electric light plant to replace the one recently destroyed by fire.

HUBBELL, NEB.—Bonds have been authorized for the installation of a municipal electric light plant.

LIBERAL, KAN.—Plans have been perfected by the City Council for establishing a new lighting system on the principal thoroughfares in the city.

ST. JOHN, KAN.—An election will be held June 10 to submit to the voters the proposal to issue $50,000 in bonds for extensions to the municipal electric light plant and waterworks system.

WICHITA, KAN.—The Wind Electric Sales Company, 407 East Douglas Street, recently incorporated, is preparing plans for the erection of a factory to be located north of Wichita, for the purpose of manufacturing power plants for suburban homes, utilizing wind to generate electricity.

Southern States

DURHAM, N. C.—Preparations are being made by the city for the installation of an ornamental lighting system to cost about $30,000. Contract for the standards has been awarded to the Durham Traction Company. The work will be done under the supervision of Mr. Waddel, electrical engineer.

HOBGOOD, N. C.—The installation of a municipal electric light plant in Hobgood is under consideration.

EHRHARDT, S. C.—The Ehrhardt Manufacturing Company, recently organized, is planning to install electric and telephone systems, ginnery and ice factory.

LYERLY, GA..—Work has started on the construction of the power plant of the Chattooga River Power Company on the Chattooga River in East Lyerly. It is expected that arrangements will be made with the company for lighting the streets in Lyerly and for furnishing electricity for commercial and residential lighting purposes.

KEY WEST, FLA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to erect a power house and install a fire protection system at the local navy yard, to cost about $20,000. Specification 3896.

MOORE HAVEN, FLA.—C. M. Bush, president of the South Florida Farms Company, has presented the town with an electric light and water plant.

WINTER GARDEN, FLA.—At an election to be held June 2 the proposal to issue $75,000 in bonds for the installation of water, lighting and sewer systems will be submitted to the voters. The work will include two 30-hp. motor-driven pumps, directly connected, 40,000-gal. iron tank on a 75-ft. tower, power house and 2½ miles of sewer with septic tank. W. H. Reams is Mayor.

LAFAYETTE, TENN.—The installation of an electric lighting system in Lafayette is under consideration.

RIPLEY, TENN.—Bonds to the amount of $150,000 have been voted to construct lighting, water and sewer systems.

CLARKSDALE, MISS. — Bonds to the amount of $300,000 have been voted for improvements to the municipal electric light plant, waterworks system, sewer system, paving streets, etc.

JACKSON, MISS.—Application has been made to the City Council by the Citizens' Public Utility Company of Jacksonville to operate electric lighting, gas and street railway systems in Jackson. The company contemplates the construction of a new plant here.

EDMONDSON, ARK.—The Edmondson Stockson & Improvement Company is contemplating the installation of an electric light plant in connection with a laundry and ice-manufacturing plant. W. C. Bauchman is secretary.

HELENA, ARK.—The Helena Cotton Oil Company is contemplating equipping a plant for the manufacture of cottonseed products, including presses, power plant, etc.

BEGGS, OKLA.—Bids will be received by the Board of Trustees of the town of Beggs until June 18 for erection of a mechanical filter plant with a capacity of 500,000 gal. per twenty-four hours at the waterworks plant; also for one triplex pump and a 25-hp. electric motor.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company is planning to install one 100-cp. lamp every 150 ft. a distance of two miles along the diversion dam and at other points of the city water supply, to provide for night or emergency work. The most economical method of supplying energy to the waterworks is also under consideration.

MERCEDES, TEX.—The installation of an electric light plant in Mercedes is under consideration. W. M. Bancroft of New Orleans, La., and Hiram Hart of Brownsville, Tex., are reported interested in the project.

Pacific and Mountain States

FERNDALE, WASH.—The Commissioners of Whatcom County have granted the Puget Sound Traction, Light & Power Company of Seattle permission to erect electric transmission lines along the county roads in Ferndale.

AVALON, CAL.—A special election will be held on June 3 to submit to the voters the proposal to issue $88,999 in bonds for construction of electric light plant and waterworks system and $55,000 for gas works.

HOLTVILLE, CAL.—Plans are under consideration by the Holton Power Company for installing electric generating equipment in the dismantled power house at Holtville. The cost is estimated at $75,000 and it is estimated that 1000 hp. can be developed. E. A. Judy is district manager.

LOS ANGELES, CAL.—At the general election to be held June 3 a proposal to issue $13,500,000 in power bonds will be submitted to the voters. Of this sum $11,000,000 is required for the purchase of the distributing system of the Southern California Edison Company; $2,250,000 to complete power plant No. 2 in the San Francisquito Canyon, and $250,000 to carry out development work at Owens Gorge, where further water-power development is contemplated.

SAN FRANCISCO, CAL.—Extensions and improvements involving an expenditure of $3,400,000 are contemplated by the Pacific Gas & Electric Company during the current year. Of the money to be expended $2,028,845 will be for new electric work. Lake Spaulding and Fordyce dams are to be raised at a cost of about $490,000.

SAN FRANCISCO, CAL.—Surveys are being made by the Great Western Power Company of San Francisco for the erection of an electric transmission line between the Butt Valley power house and Prattville. The proposed line is to furnish power for work in connection with the tunnel from Prattsville to Butt Valley, which will carry the waters of Lake Almanor to the power plant which is being built at a cost of about $5,000,000.

SALT LAKE CITY, UTAH.—The Telluride Power Company, it is reported, contemplates establishing a power plant on one of the streams of the national forests in the southern part of Utah. A. L. Waters is superintendent of the company operating in southern Utah.

LIBBY, MONT.—The telephone system serving Libby and Troy has been purchased by E. H. Cookingham and B. P. Snowden of Spokane, Wash. The new owners contemplate the erection of a new line from Libby to Bonners Ferry, Idaho, and from there to Warland and Eureka, Mont.

MELSTONE, MONT.—The Montana Power Company of Butte has submitted a proposition to the Council offering to extend its transmission line from Carpenter Creek to Melstone on condition that an extended franchise is granted the company. It also offered to purchase the old municipal electric light plant.

TORRINGTON, WYO. — Arrangements have been made whereby electricity for operating the local system will be supplied by the government plant south of Lingle.

Canada

WINNIPEG, MAN.—Contract for the construction of a new power house at Tuxedo Park has been awarded to Carter-Halls-Aldinger, Ltd., of Winnipeg.

GLENCOE, ONT.—Plans are under consideration by the Glencoe Council and Industrial Board as to the advisability of procuring electricity from the Hydro-Electric Power Commission of Ontario.

PARRY SOUND, ONT.—A by-law has been prepared providing for an issue of $165,000 in debentures for the purpose of a hydro-electric development at the present municipal electric light and power plant and elsewhere on the Seguin River. The plans provide for the erection of a new power house and installation of machinery. J. D. Broughton is secretary and treasurer.

WINDSOR, ONT.—The City Council is considering the construction of a power house.

WINGHAM, ONT.—Plans and estimates are being prepared by the engineers of the Hydro-Electric Power Commission for the proposed connection to supply electricity in Wingham and other towns in Huron and Bruce Counties.

Miscellaneous

PANAMA.—Bids will be received at the office of the Panama Canal Commission Washington, D. C., until June 6 for furnishing tool steel, wire rope, leather belting, mica tubing, conduit bushings, condulets, etc. Blanks and further information pertaining to this circular (1280) may be obtained at the above office, or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 604 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued May 13 1919)

14,646 (reissue). COMBINATION TIMER, DISTRIBUTOR AND INDUCTION-COIL APPARATUS; Joseph H. Lehman, Hasbrouck Heights, N. J. App. filed June 15, 1915. Metal shaft utilized as core of transformer.

14,647 (reissue). RAIL BONDING; Gustav A. Merkt, Worcester, Mass. App. filed Sept. 21, 1915. Perfect and large contact.

1,303,226. PROCESS OF ELECTROLYSIS; Herbert I. Allen, Portland, Me. App. filed Feb. 1, 1917. For the recovery of metals from the soluble salts.

1,303,230. WELDING TOOL; Ralph Baker, Wilkinsburg, Pa. App. filed Nov. 3, 1917. Protects the handle from heat.

1,303,241. ELECTRIC CURRENT METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 4, 1916. An escapement device with electromagnetic means for controlling or restoring its oscillating member in accordance with any desired conditions.

1,303,242. AMPERE-HOUR METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 4, 1916. For controlling the operation of movable members so that they will rotate in accordance with the first power of the current.

1,303,243. AMPERE-HOUR METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 4, 1916. Escapement device oscillates in accordance with the force applied.

1,303,244. MAXIMUM-DEMAND METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 12, 1916. Indicates the average value of load.

1,303,273. ELECTROTHERAPEUTICAL DEVICE; William A. D. Evans, New York, N. Y. App. filed July 25, 1914. Portable.

1,303,274. ELECTROTHERAPEUTICAL DEVICE; William A. D. Evans, New York, N. Y. App. filed July 25, 1914. Portable.

1,303,281. NON-INDUCTIVE INTERFERENCE SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 28, 1917. Inductive interference minimized and power factor controlled.

1,303,282. DISTRIBUTING SYSTEM FOR MINIMIZING INDUCTIVE INTERFERENCE; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Aug. 9, 1915. An alternating-current railway system.

1,303,284. KNIFE-BLADE SWITCH; Harrison J. L. Frank, Detroit, Mich. App. filed Aug. 7, 1918. Supports and clips which are held in proper adjustment to receive the switchblades.

1,303,286. ELECTRIC BATTERY; Harry F. French, Fremont, Ohio. App. filed Dec. 17, 1915. Requires no diffusion of liquid.

1,303,291. SPEED TRANSFORMER; Maximilian M. Goldberg, Dayton, Ohio. App. filed July 10, 1915. Allows variable speeds when attached to constant-speed motor.

1,303,307. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed June 19, 1915. Motor accelerated by a small motor-generator, thus reducing energy losses.

1,303,308. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed July 12, 1915. Series field winding excited by armature current during regenerative operation.

1,303,309. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Aug. 10, 1915. Regenerated currents of plurality of parallel-connected dynamos maintained.

1,303,310. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 10, 1916. Regenerative currents obtained with heavy armature currents.

1,303,311. STORAGE-BATTERY CONNECTOR; Clarence W. Hazelett, Lakewood, Ohio. App. filed Oct. 30, 1916. Detachable.

1,303,319. MOTOR CONTROLLER; Albert J. Horton, White Plains, N. Y. App. filed Feb. 10, 1917. Effects synchronous operation of plurality of motors.

1,303,323. HEATER SYSTEM; Lee P. Hynes, Albany, N. Y. App. filed June 14, 1918. Car-heating apparatus.

1,303,324. ELECTRIC INSULATOR; Ray P. Jackson, Edgewood Park, Pa. App. filed May 14, 1915. Hollow cylinder allows for creepage.

1,303,325. SPARK INTENSIFIER; Hugh James, Montrose, Ill. App. filed July 18, 1917.

1,303,337. CONTROL APPARATUS FOR INDUCTION MOTORS; Edwin Lehr, Pittsburgh, Pa. App. filed Sept. 10, 1915. Relay limit switch.

Record of Electrical Patents

Notes on United States Patents

1,303,342. SYSTEM OF CONTROL; Walter O. Lum, Wilkinsburg, Pa. App. filed March 30, 1914. Stores energy during light load.

1,303,349. CONTROL APPARATUS; Robert D. McManigal, Jr., Pittsburgh, Pa. App. filed July 6, 1917. Air brakes applied automatically at end of regenerative period.

1,303,351. HOOK SWITCH AND CIRCUITS THEREFOR; Ray H. Manson, Rochester, N. Y. App. filed Dec. 18, 1916.

1,303,360. VOLTAGE REGULATOR; Archie F. Moray, Cedars, Quebec, Can. App. filed Aug. 21, 1914. Voltage raised or lowered by an excitation circuit.

1,303,383. TELEPHONE PROTECTIVE APPARATUS FOR TELEPHONE LINES PARALLELING POWER LINES; Ralph W. Osborne, Hamilton, Ont., Can. App. filed Jan. 28, 1918. Uses ordinary telephone apparatus.

1,303,396. MAGNETIC ORE SEPARATOR; Lewis G. Rowand, Brooklyn, N. Y. App. filed June 21, 1917.

1,303,397. MAGNETIC SEPARATOR; Lewis G. Rowand, Brooklyn, N. Y. App. filed June 21, 1917.

1,303,398. MAGNETIC ORE SEPARATOR; Lewis G. Rowand, Brooklyn, N. Y. App. filed June 21, 1917.

1,303,404. RESISTANCE UNIT; Arthur Simon, Milwaukee, Wis. App. filed Oct. 9, 1914. Resistor and terminals are integral.

1,303,417. GOVERNOR; George S. Tiffany, Summit, N. J. App. filed Aug. 7, 1914. For electrically driven phonographs.

1,303,422. DIRECTION-SIGNALING MECHANISM FOR MOTOR VEHICLES; Paul W. Vanderhoff, Topeka, Kan. App. filed May 1, 1917.

1,303,423. SWITCH FOR MOTOR-VEHICLE SIGNALING DEVICE; Paul W. Vanderhoff, Topeka, Kan. App. filed Feb. 27, 1917.

1,303,453. ELECTRIC BATTERY; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Dec. 2, 1916.

1,303,457. MAXIMUM-DEMAND METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 4, 1916. Escapement device retards time of operation.

1,303,459. ELECTRIC BELL; Carl H. Buhl, Cleveland, Ohio. App. filed Jan. 16, 1917. Gives three separate sounds.

1,303,464. DISTANT-CONTROL-SWITCH SOCKET FOR ELECTRIC LIGHTS, ETC.; James M. Davis, Dallas, Tex. App. filed June 8, 1917. Switch plugs in at socket.

1,303,469. IGNITION GENERATOR; Ignatius P. Galantin, Chicago, Ill. App. filed Nov. 16, 1918.

1,303,478. STORAGE-BATTERY GRID; Leon E. Hills, Lakewood, Ohio. App. filed Nov. 15, 1916. Readily machined.

1,303,481. METHOD OF SERIES ARC WELDING; Otis A. Kenyon, New York, N. Y. App. filed Jan. 9, 1918.

1,303,484. ELECTRICALLY CONTROLLED CLUTCH; Walter Langdon-Davies, Weybridge, Eng. App. filed June 3, 1916. Speed controlled.

1,303,496. SELECTING SYSTEM; Paul M. Rainey, West Hoboken, N. J. App. filed Feb. 19, 1917.

1,303,511. INSULATION FOR ELECTRICAL APPARATUS; William J. Shackleton, Scotch Plains, N. J. App. filed Aug. 16, 1917. High dielectric strength.

1,303,513. STORAGE BATTERY; Thomas Spencer, Philadelphia, Pa. App. filed Sept. 30, 1916. Method of applying the active paste.

1,303,519. ELECTROLYTIC CELL AND ELECTRODE THEREFOR; Alexander T. Stuart, New York, N. Y. App. filed Aug. 27, 1918. Polarization and internal resistance are reduced.

1,303,523. TIMBER-DISTRIBUTER MECHANISM; Edward J. Tomlinson, Newark, N. J. App. filed Nov. 3, 1917.

1,303,524. BINDING POST FOR ELECTRIC CABLES; Edward J. Tomlinson, Newark, N. J. App. filed Feb. 18, 1918.

1,303,528. TELEPHONE-EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed June 23, 1916.

1,303,558. BATTERY CELL; Harry T. Hipwell, Pittsburgh, Pa. App. filed March 6, 1918. Allows good connection.

1,303,575. WELDING ELECTRODE; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed March 22, 1918. Provided with a removable metal lining.

1,303,579. SYSTEM FOR SUCCESSIVE AMPLIFICATION OF ENERGIES; Alexander McL. Nicolson, New York, N. Y. App. filed April 16, 1915.

1,303,582. PANELBOARD CONSTRUCTION; Edwin A. Olley, Syracuse, N. Y. App. filed Aug. 2, 1915. Widthwise dimension reduced.

1,303,600. MAGNETO FOR INTERNAL-COMBUSTION ENGINES; Herman Schmid and Gottlob Fuegel, Brooklyn, N. Y. App. filed July 18, 1917.

1,303,609. ELECTRIC PLUG AND SOCKET CONNECTION; William Stewart, West Kogarah, New South Wales, Australia. App. filed Aug. 21, 1917. Uses locking bond.

1,303,625. RECEIVING INSTRUMENT FOR WIRELESS SIGNALING; Alessandro Arton, Turin, Italy. App. filed Nov. 2, 1917.

1,303,626. ELECTRICALLY GOVERNED KEY-OPERATED MECHANISM; John T. Austin and Basil G. Austin, Hartford, Conn. App. filed Jan. 11, 1919.

1,303,627. TREATMENT OF IRON OR STEEL OR OTHER ARTICLES; Henry C. Baines, Springfield, Mass. App. filed Aug. 10, 1916.

1,303,634. PUSH-BUTTON SWITCH; Joseph O. Cadieux, Meriden, Conn. App. filed Dec. 27, 1918. Easily assembled.

1,303,655. TELEPHONE SYSTEM; Georg Grabe, Nikolassee, near Berlin, Germany. App. filed Oct. 15, 1913.

1,303,669. HEATER SYSTEM; Lee P. Hynes, Albany, N. Y. App. filed May 21, 1918. Car heating thermostatically controlled.

1,303,670. HEATER SYSTEM; Lee P. Hynes, Albany, N. Y. App. filed May 21, 1918.

1,303,681. ELECTRIC WELDING; Otis A. Kenyon, New York, N. Y. App. filed Jan. 9, 1918. Artificial line resistance.

1,303,688. TROLLEY HANGER; John Leisenring, Springfield, Ill. App. filed Sept. 21, 1915.

1,303,729. WIRELESS SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed Jan. 10, 1919.

1,303,730. RADIO SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed Jan. 11, 1919.

1,303,771. IGNITION DEVICE; Melvin M. Caster, Lowell, Mass. App. filed June 25, 1917.

1,303,776. ELECTRIC REGULATION; John L. Creveling, Auburn, N. Y. App. filed May 17, 1915. Speed and output regulated.

(Issued May 20, 1919)

1,303,843. ELECTRIC BATTERY; George N. Antonoff, London, Eng. App. filed Aug. 12, 1918. Dry primary cell.

1,303,844. ELECTRIC BATTERY; George N. Antonoff, London, Eng. App. filed Aug. 12, 1918. High output of dry cell.

1,303,863. ELECTRIC PERFORATING AND RECORDING MACHINE; George H. Davis, West Orange, N. J. App. filed July 10, 1914. Perforates music paper.

1,303,876. ELECTRIC SWITCH; Arthur E. Francis, Cleveland, Ohio. App. filed Oct. 2, 1917. Automobile.

1,303,901. ELECTRIC SIGNALING DEVICE; William M. Horton, Cleveland, Ohio. App. filed July 19, 1916. Solenoid and armature are electrically energized.

1,303,906. MULTIPLE SPOT-WELDING MACHINE; Otto H. Jobski, Cleveland, Ohio. App. filed Aug. 29, 1916. Operates simultaneously.

1,303,919. SPOT-WELDING ELECTRODE; Laurence S. Lachman, New York, N. Y. App. filed July 19, 1918. Concentrates flow of current and pressure.

1,303,937. TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Nov. 25, 1914.

1,303,958. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed July 19, 1915.

1,303,960. CONNECTING CIRCUIT FOR TELEPHONE SYSTEMS; Ralph L. Quass, Hawthorne, N. J. App. filed July 19, 1917.